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ABSTRACT

Twenty-five conference papers are presented along with the conference agenda, two welcoming speeches, and lists of conference speakers and participants. The conference focused on the use of video and computer technology in foreign language instruction. The individual papers address such topics as: (1) video design and methodology for foreign language teaching, (2) a computer-based language instruction system, (3) interactive video, (4) computer-managed instruction, (5) a model for designing instructional systems, (6) multilingual processors, (7) microcomputers in language instruction, (8) video retrieval systems, (9) student-controlled interactive videodiscs, (10) computer games for German language teaching, (11) future technology in voice recognition and word verification, and (12) a user design program for the Apple II computer. (RW)

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Defense Language Institute
Foreign Language Center
Presidio of Monterey, California

21-24 September 1982

PREFACE

This document is a collection of presentation texts from the third annual Foreign Language Instructional Technology (FLINT) Conference. Co-sponsored by DLIFLC and the Goethe Institute, the conference was held at the Presidio of Monterey, California in September 1982. Over 100 distinguished foreign language educators and technologists participated, representing institutions in the United States, Germany, Canada, and England.

The papers published here were oral presentations. Although they have been edited to adapt them for print, an attempt was made to preserve the spontaneity and oral style of the speaker. We regret that a number of slides did not reach us in time for inclusion. Speakers' addresses are given at page 181.

Two previous FLINT conferences were held at Utah State University in May 1981 and at the Goethe Institute, San Francisco, in December 1981. A fourth FLINT conference is scheduled for November 1983 at the Goethe Institute in San Francisco. The purpose of these seminars is to share information on the application of advanced technologies to the teaching and learning of foreign languages.

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FOREIGN LANGUAGE INSTRUCTIONAL TECHNOLOGY CONFERENCE

Moderator - Dr. Francis A. Cartier, DLIFLC

TUESDAY, 21 Sep

0800 - 0900	**Conference Registration**
0900 - 1000	**Welcome** COL DAVID A. MCNERNEY, *Commandant, Defense Language Institute* *Representative, Goethe Institute*
	Keynote Address DR. JAMES E. ALATIS, *Dean of School of Language and Linguistics, Georgetown University, Washington, DC*
1000 - 1030	**"Considerations on the Use of Technology in the Learning of Foreign Languages"** ED SCHNEIDER, *Syracuse University, Syracuse, NY*
1030 - 1100	**"Video Design and Methodology for Foreign Language Teaching"** JOAN RUBIN, *Consultant, Pinole, CA*
1100 - 1115	**Coffee Break**
1115 - 1145	**"A Computer-Based Language Instruction System"** LAWRENCE MARKOSIAN, *Institute of Mathematical Studies and Social Sciences, Stanford University, CA*
1145 - 1215	**"High Technology, Productivity and Training"** TOM ARKWRIGHT, *Lockheed Missiles and Space Co., Sunnyvale, CA*
1215 - 1245	**"The German TICCIT CAI Program"** RANDALL JONES, *Brigham Young University, Provo, UT*
1245 - 1400	**Lunch**
1400 - 1430	**"Ergonomic Input"** MARK RICHARD-FOGG, *Marc Fogg Software, San Francisco, CA*
1430 - 1500	**"Teaching the Receptive Skills"** DAVID WYATT, *American Language Academy, Catholic University, Washington, DC*
1500 - 1530	**"Template or Free-Form Systems? A Look at the Issues"** GLYN HOLMES, *University of Western Ontario, Canada*
1530 - 1600	**Coffee Break**
1600 - 1900	**WORK GROUP SESSIONS**
1900 - 2030	**Welcome cocktail hosted by the Goethe Institute** **Presidio Officers and Faculty Club**

WEDNESDAY, 22 Sep

0900 - 0930	**Keynote Address** DR. DAVID M. WEIBLE, *Director of Audio Information Service, University of Illinois at Chicago, IL*
0930 - 1000	**"How Teacher-Independent Can CAI Courseware Be?"** FRANCIS OTTO, *Brigham Young University, Provo, UT*
1000 - 1030	**"Improved Approaches for Designing Foreign Language Instruction"** MICHAEL DEBLOOIS, *Utah State University, Logan, UT*
1030 - 1100	**"Upgrading a Learning Laboratory Environment to Accommodate Videodiscs and Microcomputer Delivery Systems"** DALE LALLY, *University of Louisville, KY*
1100 - 1115	**Coffee Break**
1115 - 1145	**Panel Discussion**
1145 - 1215	**"Analysis and Design Model for Foreign Language Instructional Systems"** PAUL MADARASZ, *Defense Language Institute, Presidio of Monterey, CA*
1215 - 1245	**"Multilingual Processors"** CARL LEHFELDT, *Acurex, Mountain View, CA*
1245 - 1400	**Lunch**
1400 - 1430	**"Methods of Using Microcomputers in Foreign Language Instruction"** JOHN RUSSELL, *State University of New York Stony Brook, NY*
1430 - 1500	**"Video Retrieval Systems for Foreign Languages"** SUE OTTO, *University of Iowa, Iowa City IO*
1500 - 1530	**"Using Research-Based Principles to Design Student-Controlled, Interactive Videodiscs: Do The Old Rules Still Apply?"** LARRIE GALE, *Brigham Young University, Provo, UT*
1530 - 1900	**WORK GROUP SESSIONS**

THURSDAY, 23 Sep

0900 - 0930	**"Presentation and Discussion of the Interactive Program MONTEVIDISCO"** JUNIUS BENNION, *Brigham Young University Provo, UT*
0930 - 1000	**"Klavier im Haus" - an Annotated Version"** PAUL LUCKAU, *Brigham Young University, Provo, UT*
1000 - 1030	**"Making Existing Video Material Interactive"** CAPT MICHAEL BUSH, *US Air Force Academy, CO*
1030 - 1100	**"SPION: 'Intelligent' Games for German Language Teaching"** RUTH SANDERS, *Miami University, Oxford, OH*
1100 - 1115	**COFFEE BREAK**
1115 - 1245	**PRESENTATION OF WORK GROUP RESULTS**

FRIDAY, 24 Sep

0900 - 0930	**"Compressed Audio and Second Generation Videodisc Systems"** STAN JARVIS, *Electronic Information Services*
0930 - 1000	**"Some Trivial Ways of Using a Microcomputer in Language Teaching** HANNO MARTIN, *Goethe Institute York, Great Britain*
1000 - 1030	**"A User Design Program for Apple II** JAMES PUSACK, *University of Iowa, IO*
1030 - 1100	**"Today's 'Future' Technology For Language Study, Voice Recognition and Word Verification** BRIAN SCOTT, *Scott Instruments, Denton TX*
1100 - 1130	**Coffee Break**
1130 - 1330	**EVALUATION-DISCUSSION-REPORT**

WELCOME ADDRESS

COLONEL DAVID A. MCNERNEY
COMMANDANT

Defense Language Institute
Foreign Language Center

First of all, I want to welcome all of you here to this Third Annual FLINT Conference, and I am sure you are as glad as I am to be here. I think you are all aware that this conference is the culmination of a brilliant dream on the part of Dr. Peter Grune of the Goethe Institute and Lt Col Trautsch of my staff, who put in a heck of a lot of work on this. It's also the fruit of a lot of hours of hard work over the past year by representatives of the Goethe Institute, Utah State University, Brigham Young University, and of course, some members of my staff. In particular, I would like to recognize the efforts of two young ladies who worked pretty hard on this; Ms. Chris Settember of the Goethe Institute and Ms. Karen Kelley from my Educational Technology Division are the "Indians" who put together all the details. I would like to thank them because without their fine efforts we just wouldn't have put all this together.

I'd like to focus a little bit on some of the common interests that bring us here. We have really two essential ones: first is the teaching of foreign languages and the second is the use of technology in that endeavor. The demands of the world that we live in have far outstripped our ability to produce linguists to meet the demands of diplomacy, business, education, and defense. I think you can look around the world and see how we Americans are particularly deficient in that area. I don't have to talk about President Carter's gaff about "lusting for the Polish people," or the fact that in Afghanistan, which has a major border with the Russian nation, when a Russian soldier defected we didn't have a single person in that embassy who could speak either Russian or German. So each of us here is looking for ways to solve that dilemma we have of how we can use technology in foreign language training.

We at the Defense Language Institute have just started on a series of projects that I can probably best describe to you as the implementation of Toffler's *Third Wave* or his earlier book *Future Shock*. I will emphasize to you the strides that we've made in the area of technology. As I was growing up, if I wanted to do any calculations, I had a big hand-crank machine. I punched numbers in it and cranked it, and a little piece of paper rolled up. Over the years that machine got smaller. It worked faster. It was electronically operated. A couple of years ago I used to carry around in my pocket one of these little calculators. As I sat up there doing my duties in a senior management position, I was managing budgets of millions of dollars on that little calculator. Last week my wife gave me as a birthday present a watch with a built-in calculator on it. It's not only got a calendar and a stopwatch; it's got an alarm clock. It's also got a little game mode on it. That is where technology has taken us in a very short period of time, and we have to keep that rapid advance in mind.

In the August issue of *Byte* magazine, Chris Morgan speaks of a potential crisis in American computer research and development today. He states that one of the causes of this crisis is the lack of foresight. While there may be a crisis, I don't see any evidence of a lack of foresight among those present here because that's why we're together. I recognize that there are a lot of hurdles as we do this. We face the hurdles, all of us, of people who are well-entrenched in certain means of imparting language instruction. We face hurdles, all of us do, of budgetary constraints that restrict us in our ability to put this new technology together. So I would tell you that that's the purpose for our being here--because the problem is so big that we need to share ideas. I don't think there is any single agency, school, or institution around that is capable of putting all this technology together and coming up with one approved or best solution. We are here to try to share ideas and to work together.

In effect, all of us here are going to have to play two roles, both of which you're very adept at: that of the master and that of the disciple. The key is your ability to grasp new ideas and look for the best possible way to teach. As we start on the edges of some of this technology, I will tell you that our Armed Forces are bringing in here some absolutely superb individuals in terms of intellectual capacity. Remember, this is not just the generation that grew up watching television; this is the generation that is out playing a series of very complex video games. I constantly remind my staff that we have to think in terms of that forward type of technology.

I read in a magazine not too long ago that in an effort to teach retarded children how to do their mathematical tables, which all of you recognize as a horrible, dull, slow process, they converted one of these video games. Asteriods would come in with numbers on them like two times six, three times seven, and you had to punch in the number and then shoot in the right direction as the asteriods were coming in at varying speeds. The results were rather spectacular in terms of the pupils' assimilation of this material. First of all, they were standing there learning it, concentrating, mentally computing the mathematics and considering which of these asteriods was coming fastest on this rather simple game. But in addition to the student playing, about five other students in that class were standing there ready to say, "Dummy, I knew what it was." All of them were standing there doing their calculations. The results were rather astonishing.

I would also tell you that all of you ought to go and watch the intensity of some of the students' efforts on video games. We have a building known as the Tin Barn which we're temporarily using as an enlisted club. There are 11 video game machines over there, and you should watch those kids applying that intensity of effort--total concentration. If I can match that with 11 or even one or two video machines that have PAC-MAN that teach foreign languages, I'll be eminently happy; but it is that ability to get the total concentration of the student that's really critical. And there are many ways to do that. And that's one of the reasons we're here.

So finally I want to wish on behalf of myself and for DLI that you have a very pleasant and productive week. I also encourage you if you've got some time, and I recognize that we have a pretty busy schedule, just to enjoy this beautiful Monterey Peninsula. If there is anything we can do to assist you, please let us know.

WELCOME ADDRESS

KARL-PETER GRUNE
DEPUTY DIRECTOR

Goethe Institute, San Francisco

When, in May 1981, the Goethe Institute, San Francisco, and Utah State University in Logan, Utah, agreed to conduct a workshop about interactive computer and videodisc technology and design, none of the participants could have guessed where FLINT as we called this meeting would finally go. There were a couple of experts, headed by Prof. Dr. Mike DeBloois who introduced some 25 laypersons to the intricacies of high technology applications in education. The group of workshop participants, however, though novices in the technological field, contributed significantly to this first conference through their methodological and practical experience in teaching German as a foreign language. This expertise materialized in the form of an interactive program for the German television episode "Klavier im Haus." Though by necessity rudimentary, this interactive design was developed and programmed on the spot and simulated at the end of the workshop. As time went by, more experts and organizations took interest in the FLINT group and the active association of the research team of Brigham Young University in Provo, Utah, and the Defense Language Institute in Monterey added new dimensions to the common efforts. Today, we look at "Klavier im Haus" in its first interactive disc version. The brilliant contributions and demonstrations by experts from all over the United States and abroad have made this conference a milestone in the field of technology application for foreign language teaching. We are now looking forward to the next FLINT Conference in November 1983 in San Francisco, and in the more distant future to a FLINT Conference in Frankfurt, Germany, probably in June 1984.

On behalf of the Goethe Institute, San Francisco, I'd like to thank everybody once again for their contribution, and in particular the Defense Language Institute in Monterey for their efficient organization, warm hospitality, and for sharing their varied and vast experience in the field of foreign language teaching.

FIRST KEYNOTE ADDRESS

THE APPLICATION OF INSTRUCTIONAL TECHNOLOGY TO LANGUAGE LEARNING

DR. JAMES E. ALATIS
DEAN, SCHOOL OF LANGUAGE AND LINGUISTICS
Georgetown University

I am very pleased to have been given this opportunity to come here today and talk about the "Application of Instructional Technology to Language Learning." I am sure that you are all aware of the widespread myth that educators in general, and humanistically-oriented teachers in particular, regard new technologies as to be fought at every turn. As a humanist, I especially welcome this opportunity to comment on the issue and emphasize that the myth referred to is sheer nonsense.

In a chapter called "The Decline of the Professions," Christopher Evans claimed in his book, *The Micro Millenium*, that computers would make available to everyone the knowledge laboriously acquired and jealously guarded by the traditional professions such as medicine, law, and teaching, which would therefore gradually wither away or lose importance.[1] This prophecy was made in 1979. Now that computer terminals have found their way into people's homes, such predictions are heard more often and with no less alarming tone. We are told that the training classroom of the year 2000 will do without textbooks, and all-knowing instructors. We hear that the inevitable infusion of "high technology" devices into our educational system will "kill off" some of the educators, and that the "Computer Revolution" will make the classroom obsolete. We are encouraged to believe that parents may decide that buying their own equipment to provide self-instruction for their children may make more sense then sending them to school. In short, there are those who are fearful that the so-called "electronics culture" has sounded the last ding-dong of doom for the entire system of traditional education which is the product of the book-oriented world of the print culture.

Undoubtedly, an electronic revolution of a kind is in the making. There is ample reason to believe that computers will soon affect our lives through the labor force, the education system, our families, and society at large. But the kind of changes I personally foresee in our educational system provide an occasion for rejoicing rather than a cause for panic. I would like to support my view by the words of Donald L. Bitzer, inventor of the PLATO* computer system, who believes that the application of computers will make the demand for teachers greater, not lesser. "If I were a teacher," he says, "I would be terribly excited about the future.[2] I suggest that the concern of those who view technology as a threat to the present system of education is an expression of mental blindness to the role and the purpose of education in our highly advanced and complex society.

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*Programmed Logic for Automatic Teaching Operation

To begin with, such reactions against sudden cultural and technological changes as mentioned above are not rare in the history of mankind. It has been pointed out that in Plato's *Phaedrus* Socrates feared that writing would destroy memory and wisdom by enabling people to compile quantities of lifeless information.[3] And Yale's President Giamatti, as a Renaissance scholar, cited similar apprehensions that underlay denunciations of printing when it began to spread in the sixteenth century. To refer to cases in our time, high-flown, unacceptable claims for the value of radio in the 1920s, films in the 1930s, television in the 1950s, teaching machines in the 1960s, and dial-access technology and language laboratories in the 1970s are good examples of false prophecy and consequent disappointment.

This is not to underestimate the impact of the new technological developments upon educational practice. Rather, I want to emphasize the well-known fact that computers have little tolerance for ambiguity, or capacity for awareness of context or metaphor, or perception of the question not yet posed. Thus, as long as such human factors as insight, intuition, and imagination remain indispensable to man's life, humanistic teaching will play a basic role in educational programs. How can it be otherwise? At best, computers will help us transmit more information to more people with better effect, in less time, and with greater efficiency than ever before. But why do we transmit information to people at all? The minute this ultimate question is asked, the function of instructional technology, however advanced, stops, and the crucial mission of educators begins. It is essential in this context to distinguish between "training," which provides specific skills, from the much broader function of "education," which is to make of people responsible and fully integrated personalities, conscious of their unique and privileged task in society. We have to remind ourselves that learning is not merely storing a series of facts or developing specific skills. Above all, it is a responsibility for the integrity of what we are as ethical creatures. Professional ability is not knowing just how to do a job. It means demonstrating in one's everyday work a total commitment to one's skill. If we can ever think of a time when American society would no longer need responsible and committed individuals, but only cartoon-like figures and aborted personalities, that would be the time when computers could make humanistic teaching truly redundant.

Those who view computer technologies as an alien intrusion ignore this humanistic task of education. Confusing the means with the end, they consider any basic changes in methodology as a threat to the status quo and to their job security. Indeed, technology can be destructive if it fails to function in response to a specific and clearly defined objective, or if its application is not based on genuine needs. In his address delivered before [sic] the American Council on the Teaching of Foreign Languages annual meeting, Mayor Charles Royer provided a glaring example of this. He stated:

> I remember talking with a former Peace Corps volunteer about his experiences in Africa. I

> asked him if the Peace Corps and other foreign aid programs had much impact on the economy there. He nodded. "Yes," he said, "we totally ruined their agricultural economy." I was shocked. I asked him how we had managed to do that. "By selling them tractors. They couldn't afford them to begin with, and there was no one to service them when they broke, and no spare parts. They went into debt to buy those tractors when what really would have helped was a good steel plow." My young friend had lived with the people he was talking about and spoke their language. He had a keen sense of the tools that were needed to build that country. They badly need this kind of knowledge in the idle steel mills of Youngstown and Gary.[4]

Similar disasters are likely to occur in instructional situations in which technological applications are isolated from the mainstream of the educational program or used for irrelevant purposes. Purchasing equipment in response to a "technology push," and not on the basis of an "education pull," is a destructive practice that turns technology into a hostile intruder. If I may use an analogy: when you transplant a kidney, the body reacts. The stresses as the body tries to reject the alien organ are so critical that for a time it is life fighting against death. I wish to suggest that technology invites such a reaction where its application has little or no relationship to what is actually needed.

What is, then, the specific humanistic objective of language instruction and how can modern technological developments help us achieve it? To define this objective in relation to present-day American society, we have to make a quick reference to the alarming nature of the cross-cultural problems which continue to abound both inside and outside America. Let us first consider this point within the framework of our own society. You are all very well aware of the statistics and data concerning the entry of immigrants, refugees, documented and undocumented aliens to our shores. According to recent findings, a flood of immigrants is bringing well over one million newcomers a year into the United States--the highest level since the mass migration of Europeans at the turn of the century. By some estimates, El Salvador alone has generated as many as 500,000 U.S.-bound refugees since 1980. America today is accepting twice as many immigrants as all other nations combined. "If immigration is continued at a high level," warns Senator Alan Simpson, chairman of the Senate Subcommittee on Immigration, "and a substantial portion do not assimilate, they may create some of the same social and economic problems that exist in the countries from which they come."[5]

Nor is the international aspect of the situation any less alarming. If it is true that one out of eight manufacturing jobs is dependent on exports, and that one of every three American acres is planted for agricultural export, then it is evident that our tie with other countries is not just an adjunct, but an essential condition of our survival as an affluent society. Indeed, if we want to maintain our position of leadership in the world, we must make ourselves capable of responding effectively to the need for a spirit of kinship--of a common humanity--with other peoples. The only key to the achievement of this goal lies in strengthening our ability to communicate with other nations. If we fail to do this, we must be prepared to face the kind of consequence against which the ominous words of former U.N. Secretary General Kurt Waldheim warned us: "Many civilizations in history have collapsed at the very height of their achievement because they were unable to analyze their basic problems, to change direction and to adjust to the new situation which faced them."[6]

Thus, nothing less than our survival as a great nation demands that we, as committed educators, should use our most powerful weapon--humanistic teaching--as effectively as we can to help create a sense of unity among men, which is an indispensable condition of peace and general prosperity. It is precisely in this connection that language instruction can truly fulfill its most creative role. To make this point clear, let me remind you of my position as a committed language educator. I subscribe to a philosophy of language teaching which emphasizes the humanistic basis of the language profession. It defines the ultimate function of language study as an attempt "to achieve an understanding, as complete as possible, between people of different linguistic backgrounds." (Fries, 1955, p.10) I strongly support the notion that learning a foreign language is a "liberalizing" experience because it serves to free one from the shackles, the restraints, and the barriers imposed by such limitations as confinement to a single language. Indeed, I have always insisted that even the study of language as language is a humanistic study; that is, all the uses and manifestations of language and linguistic communication, in all their philosophic, social, geographic, and ethnic splendor, are the basis of a humanistic discipline.

Seen in this light, language study assumes a function that extends beyond academic objectives to social and international considerations. It can be charged with the task of contributing to the improvement of the human condition--indeed, even to the survival of mankind.

To achieve this end, it is clear that we must explore all possibilities that might help us do our job more efficiently. One such possibility is offered by modern language teaching technology, which appears to have great potential for improving and facilitating the learner's progress. Specialists inform us that marvelous new opportunties concerning language teaching technology are forthcoming as a result of recent developments in audio, video, and computer techniques. However, to use the new aids and equipment to best advantage and toward the most direct realization of our educational goal, we must first try to learn the lessons from the first wave of language teaching technology that started with the introduction of the language lab. The results of careful, empirical, and longitudinal research concerning language laboratories have left little doubt that many people have been disappointed. Expectations of the early sixties have often slid into apathy, if not rejection, of many audio-lingual practices. Educators have a major responsibility to change this attitude--which seems to be widespread among students as well as teachers--by explaining to them what exactly went wrong. It seems appropriate to refer in this regard to Peter Strevens, who in his attempt to dispel some of the "myths" that arose in the course of the first wave of language teaching technology, states:

> Much of the negative reactions by students toward language labs is caused by the unfortunate quality of dull solemnity which most language lab tapes possess. Lack of wit and humor makes learning tedious, boring, and unproductive. It is worth noting that one component of the new technology, namely computer programming, takes wit and humor for granted. Programs are very often written with humor, irony, and an awareness of the user as an intelligent human bei[illegible]se are characteristics that we must bring into the new language teaching technology, so that we never again produce the reaction on the part of students learning languages through the use of technology: "This is boring; I can only stand 20 minutes of it; and anyway I'm really thinking of something much more interesting." Such a reaction reflects, in the last resort, against us as teachers.[7]

Fortunately, since the time when the language lab was introduced, our understanding of what actually takes place when people learn and teach a foreign language has been enhanced considerably. We are now in a position to recognize and evaluate instantly the potentials as well as the limitations of a given teaching method or technique. This protects us against some of the possible negative impacts that modern instructional technology may have upon the language teaching processes. To give but one example, it has been pointed out that "The computer offers many advantages for individualized instruction: it has infinite patience and often an attractive 'personality'...it can diagnose, test, and retest a pupil's weaknesses; it allows branching to deal with individual errors, which the tape recorder cannot do; it gives the pupil a sense of being-in-control without needing to feel embarrassed at his own weaknesses."[8]

Undoubtedly these are some of the optimal conditions for second language acquisition which our era of student-centered learning values most. At the same time, we should not ignore the observation that learning by means of a computer-assisted instructional program may only favor students with what in psychology is referred to as a "sensing type" personality; that is, those who have the ability to concentrate quietly, are able to pay attention to details, have an affinity for memorizing facts, and can stay with a single task until completed.[9] If this observation is correct, then for the learner who craves the presence of other people, and is deeply concerned with other people, the inanimate computer will fail to satisfy his preference, or conform to his learning style.[10] Thus we have to keep in mind that computer-assisted instruction cannot solve all of the problems facing language study.

To conclude: All the signs are that a new surge in language teaching technology is forthcoming. In order for us to employ the new aids and equipment in a deliberate and effective way, we have to remind ourselves of the fact that language learning embraces a very wide range of variables, and that no single method can possibly be equally appropriate in all circumstances. We must remember that modern technological advances will "revolutionize" our profession only in the sense that they will enable us to achieve our educational objective more efficiently. Our single most important bulwark against unfavorable technological intrusion is our acute awareness of the humanistic task of our profession. It is not enough to know how to teach language. We must also constantly remember why we are teaching it. With this awareness, let us hope that the new wave of instructional technology will successfully take us through to the twenty-first century, and beyond. Thank you for letting me share these thoughts with you.

NOTES

1. See *NALLD Journal*, Vol. 16, No. 3/4, 12.

2. *Instructional Innovator*, Vol. 27, No. 5, 15.

3. See *ACLS Newsletter*, Vol. XXXIII, 11.

4. *Foreign Language Annals*, 14, No. 2, 1981, 124.

5. All this information is based on the data which appeared in *U. S. News and World Report*, April 12, 1982, 47-50.

6. Cited by Joseph Lurie in *America...Globally Blind, Deaf and Dumb*.

7. Strevens, Peter. "Old Myths, New Technologies and the Better Management of Learning," 7. Paper delivered at FLEAT Conference, Tokyo, Japan, August 20, 1981.

8. Davies, Norman F. "Foreign/Second Language Education and Technology in the Future." In *NALLD Journal*, Vol. 16, No. 3/4, 11.

9. Hoffman, Jeffrey L., and Watters, Keith. "Some Effects of Student Personality on Success with Computer-Assisted Instruction." *Educational Technology*, March 1982, 21.

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CONSIDERATIONS ON THE USE OF TECHNOLOGY IN THE LEARNING OF FOREIGN LANGUAGES

EDWARD W. SCHNEIDER

Syracuse University

Ever since the introduction of the magic lantern and the stereoscopic viewer, there has been an ever-increasing tendency toward viewing each new development in educational technology as a panacea for the ills of the educational enterprise. New equipment appears simultaenously in the hands of academic researchers and third grade mathematics teachers; to paraphrase Portia, "...it falleth as the gentle rains from heaven." This would of course be the ideal way to distribute the equipment, if only it were equally effective in all of the locales where it emerges.

The argument is always made that "We can't know where the new gadgets will work until we try them out there, so one place is as good as another, when we start," but this is a pretty poor method of implementing any kind of improvement. What other industry ships a brand new product all over the country without test-marketing it first, and verifying that it will work under extremes of temperature, humidity, and hard water?

In the case of foreign language instruction, there are a number of considerations for each instructional situation that ought to be examined before high-priced equipment is rolled through the classroom door. These considerations are all well-known to experienced teachers; the purpose of this paper is merely to pull them together and begin the examination of their collective effects on the design of a comprehensive instructional system. Not all of the considerations mentioned below are equally important or equally likely in all situations, so their order of presentation is of no consequence.

I. The Linguistic Proficiency of the Teacher. If the teacher's speech is really fluent, grammatically correct, and untainted by a foreign accent, then the student is truly fortunate. If the teacher is not proficient, then other model speakers must be found. This is especially important with young children who still have an imitative ear, and it is with precisely these students that the least proficient teachers are found. If there are no individuals in the community who can serve as model speakers, then films and video tapes can be very effective substitutes. Audio tapes are not as good, because they don't show the speaker producing the speech, and they provide no visual context for the communications. Of course, films and video tapes don't work automatically. Films that may be excellent for comprehension may not do much for production skills because they don't allow the student the opportunity to produce a response. In any case, some sort of high-quality mechanical representation is necessary to provide enough hours of exposure at a reasonable cost. Time-on-task continues to be the best correlate of the progress of learning.

II. The Level of the Student. Beginning students need slow, repetitious drills with highly constrained vocabulary. Even with 20 novices in a class, a teacher has little difficulty keeping them all struggling. As they progress, they progress at varying rates; some of them are bored, and others are swamped. The advanced students need a much more rapid flow of information and they soon reach a point where the logistics of the classroom (the teacher deciding whom to call on and the slower students stumbling through the exercises at a fraction of the speed of the other students) set an upper limit on the amount and rate of interaction that is possible in the class period.

In this situation, it is the two extremes of the student population, the talented and the hopeless, who can most benefit from the technology-based drills that are interactive and individualized. The high-ability students have the most to gain because, in a set period of time, they have the potential to get much further ahead of the classroom pace than the laggards can get behind.

III. The Choice of Vocabulary and the Goals of Instruction. In most language classrooms, the vocabulary that students learn is geared to their immediate surroundings (the objects in the classroom) and their "everyday life." ("In the morning, I get up, brush my teeth, eat breakfast, and go to school.") It makes good sense to use concrete objects that are readily and easily manipulated. Unfortunately, if the student is acquiring the language so that he or she can travel overseas or even stay home and read its literature, only the grammar will stay the the same; a new vocabulary will have to be mastered, and it will be relatively harder to learn because it will be harder to visualize and retain the larger proportion of abstract terms and faraway concrete objects.

Here, you might well accuse me of fabricating a made-for-technology situation, but for the fact that the need is very real. Computer-controlled videodiscs can provide rapid access to accurate representations of thousands of events and objects. No more "walking fingers" traversing the teacher's desk to arrive at an impromptu notebook "house," and then trying to knock on a non-existent door with knuckles that, in the previous instant, were knees!

There is danger here. We technologists may be tempted to overgeneralize, to develop a "universal language disc" that will illustrate any language for use with a "total physical response" pedagogy. The idea sounds excellent, but if we do it we will lose a major advantage of the disc: we will not show the non-verbal behaviors of the foreign cultures. Laughing, greeting people, showing deference, announcing one's presence, beckoning, etc., vary drastically from culture to culture. The last thing we want to do is to suggest that there are universally accepted standards of behavior.

IV. The Pedagogical Proficiency of the Teacher. This consideration has a number of aspects.

A. The ability to adjust the rate of introduction of new material. If the teacher goes too quickly, the student develops an information overload. Too slow a rate and the student will be unable to maintain concentration, because the mind will wander to nonlinguistic associations evoked by the materials. I have seen a few very talented teachers drop in asides on the finer points of grammar and usage and watched them backfire because they destroyed the students' concentration on the immediate problem. It was the teacher's sense of linguistic rectitude that motivated the asides, not the students' need to know. This is another area where an automatic system should be welcome. But we do need to solve an important problem first: how do we trade off a student's error rate against his/her rate of progress? The problem isn't entirely philosophical; with a good strategy for review and synthesis, an empirical optimization of the new material rate shouldn't be too costly.

B. Knowledge of the differentials between native and foreign thought patterns. There is a real difference between teachers whose native language is the same as the students, and teachers whose native language is the foreign language. They both may understand the differentials to the same degree, but the native speaker of the foreign language will always speak of them in an impersonal, rational way, as if they were merely a question of breeding and manners. The teacher who has been taught the foreign language will speak of the differentials personally and emotionally, illustrating the importance of knowing the distinction with an anecdote. For example, in French, when the waiter asks if he can remove your plate, you reply: *J'ai terminé*. ("I'm finished.")

Anglophone students tend to say: Je suis fini. ("I'm done for.") The native teacher doesn't mention the distinction until a student actually makes a mistake. Then the problem is explained lexically: an individual "terminates" work, but a task or an object being worked upon is "finished." The taught teacher presents the problem in terms of the effect that it produces on a native listener: the waiter replies that the statement is surely false, and that the speaker has many good years yet to come.

Both native and taught teachers convey correct and valuable information, but it's not the same information. There are some other examples of this phenomenon that will be presented later.

Technology may be able to illustrate a larger set of differentials, with some indication of their frequencies of occurrence. It can also combine the points of view of the native and taught teachers as no single teacher could.

C. The ability to adjust the criterion for accepting student answers. This adjustment is a delicate balancing between discouraging students and misleading them. If the teacher is a real stickler, and the subjective probability of producing a 100% correct answer will approach zero, and the student's anxiety level will rise, feeding on itself because the student will hear the anxiety in his or her voice, and knowing that everybody knows will just make things worse, inhibiting both the ability and the desire to speak in class. On the other hand, if a lax teacher accepts an "almost right" verb because the hour is waning and the task of the moment is the pronunciation of certain vowels, the students will overgeneralize and have the double work of unlearning and relearning in a future lesson.

In my experience, the best teachers make three fairly distinct responses to a student reply:

1. They reinforce a prompt, well-enunciated reply by maintaining, in their response, the same rhythm and projective force that they used when they asked the question. In so doing, they are saying to the student, "We are having a conversation."

2. They evaluate the student's reply in terms of the purpose of the exercise. If the student's answer is well-informed grammatically, but it

is not the expected response, the teacher will try to "play the ball as it lies," responding conversationally and illustrating the particular confusion that the unexpected reply produces. If the answer indicates the right intent, but the wrong grammar, the teacher will reply with an alternative answer that is as close to the student's answer as possible, but correct. The teacher's voice will emphasize the necessary changes. In the case of an answer with several serious problems, the teacher's alternative will be an incomplete sentence that corrects the major flaw, and then through successive elaborations, it is built up to a complete, grammatically correct reply.

3. They correct minor imperfections by repeating the student response, with emphasis and elaboration. An assertive tone of voice shows that the initial answer was correct, and that the elaborations are just "more correct."

The worst teachers have just one correct answer in mind, and appear equally flustered by an odd-ball correct answer as by a hopeless chowder of words. These teachers make a point of finding something in every response that could stand improvement. As a result, their students develop a strategy of slurring and mumbling that works to their advantage in two ways: the teacher is so intent on hearing the correct answer that his/her mind "fills in" the uncertainties, giving the student the benefit of the doubt. Secondly, lousy diction encourages the instructor to find fault with the low-level psychomotor skill of pronunciation, instead of "more serious" cognitive skills such as choice of words or grammatical transformations. It's a bit like leaving a footlocker askew during barracks inspection so the lieutenant will have something to find.

This consideration is undoubtedly one of the toughest for today's technology; most operational computerized systems lie a lot closer to my description of the worst teacher than the best. But this is an area worthy of intensive research and development, because most practicing language teachers lie a lot closer to the worst teacher than they have any business doing.

D. Ability to provide effective mathemagenic organizers and memorizers. This is surely the most creative aspect of language instruction. The aids that a teacher creates come by probing his/her own mind to discover the associations that link one language to another, to resurrect memories of forgotten insights that taught the subtle differences between two different ways of thinking. Unfortunately, it is that personal aspect that limits the value of mnemonics; if the student is "wired up" to make the association, it's gangbusters, but if he/she isn't, the whole explanation or anecdote is wasted.

Speaking of anecdotes, I know a teacher of Chinese who is a shameless punster; to help us remember the word for "king," quo wang, he told us that if we followed the king, we wouldn't "go wrong." It works for me, but it always leaves a terrible aftertaste.

For gifted language students, I would guess that 25% of their instructor's memory aids actually interfere with their own associations. Of course, only a small percentage of the student population is in this category; for most students, anything that might facilitate long-term retention is a blessing.

There is some firm ground to build on: stressing common word origins in the two languages, and organizing lists of functionally related words, such as comparatives, model verbs, or patterns of declension, are probably effective enough to warrant universal application. Technology might be able to improve the batting average of the more idiosyncratic techniques by providing a much larger compilation than the repertoire of any one teacher.

I rather doubt it, because I think that we will need effective selection rules that will match aids to students. This area is a good example of a "knowledge gap" that can't be filled with aid of electronic magic. Of course, technology could help us gather information about which aid works for whom, but I would still want to know why it works, as well.

V. The Ability to Represent the Intellectual Power that Mastery of a Foreign Language Brings. A teacher models for his/her students the human response to the unfolding of a foreign language and its culture. It isn't enough for the teacher to show what lies beyond the door that is just opening for the students; the teacher must convey the excitement, the satisfaction, and the intellectual growth that the process of mastering the language and exploring the culture bring. If the teacher can't, this most powerful intrinsic motivator may never come into play, and the student's chances of achieving true mastery are greatly reduced.

Here again, there is a major difference between native teachers and taught teachers. Native teachers convey the sense of mastery better than the teachers of any other subject. They inspire confidence in the accuracy, integrity, and utility of what is being learned. Teachers who have themselves been taught the language convey a different message; their presence says that the task of learning is in fact surmountable. The experiences that they share illustrate the rewards of exploration, and the excitement of coping with the ever-present perils of miscommunication. In actual practice, the distinction isn't quite as sharp as I've drawn it; the native teacher can tell of his experiences in the student's country, and the taught teacher can read literary works in the foreign tongue with grace and conviction. But the points of departure for the two types of teachers are clearly different.

In this area I'm quite convinced that videodiscs, both computer-controlled and stand-alone, can really shine. They can combine both the sense of discovery and the sense of mastery with a realism and emotional appeal that only the most experienced and expressive teacher could hope to match. The trick will be to keep motivating objectives from being drowned in a sea of little teeny-weenie grammatical rules whose main appeal is their eagerness to sort student answers into two piles: "correct" and "wrong."

There are any number of additional considerations, but we must stop for a moment and look at the score box. Suppose we rate the conventional language learning system as we find in American institutions of higher education and the technology-assisted system that we are considering on the same 10-point scale of effectiveness. I don't know what your ratings would look like, but my highly subjective ones look like this:

Consideration	Without Technology	With Technology
I. Linguistic proficiency of teacher	7	9
II. Proficiency of students (variability)	3	8

Consideration	Without Technology	With Technology
III. Choice of vocabulary and goals	2	7
IV. Pedagogics		
A. Pacing	3	8
B. Differentials	4	9
C. Criteria and correction	5	1
D. Mathemagenics	3	5
V. Intrinsic motivation	5	8
Totals	32	55

There are other considerations, to be sure, and they might change the balance significantly. The scale of implementation, the geographical dispersion of the delivery sites, and the cost per successful student come to mind. We don't have enough details to assess these yet, but I'm optimistic that technology will come out ahead. I justify my optimism by referring to the pessimistic assessment of the current system detailed in Paul Simon's book, *The Tongue-Tied American*,[1] and on the absence of any alternatives to technology to rectify the situation in this decade.

NOTES

1. Simon, P. *The Tongue-Tied American.* New York; Continuum; 1980.

VIDEO DESIGN AND METHODOLOGY FOR FOREIGN LANGUAGE TEACHING

JOAN RUBIN

Pinole, CA

Advantages of Videodisc

About two years ago, I began to find out about interactive video and as a researcher of success factors in language learning, I got very excited about it. I think in many ways it is one of the most exciting high-tech developments to hit the market and it is of great interest to foreign language teachers and students.

Interactive video offers students the opportunity to interact with a machine, but in a realistic natural environment. Unlike real life, a communicative situation can be repeated, structured, and sequenced to meet the developmental learning needs of students. Unlike the classroom, where it is difficult, if not impossible, to reproduce realistic interactions with native speakers in a context-rich environment.

Another exciting aspect of videodisc is that the possibilities for mixing media are overwhelmingly rich. You can mix stills, movie segments from existing films, or use music supplements in an incredible mind-boggling array of options. The advantages of these multiple options mean that for the first time we can begin to approximate the complexities of a natural conversation where the communication is a cooperative task which depends on the nature of the interaction. With the variety of media, we can also approximate the problem-solving strategies that an individual might follow in trying to ascertain what sorts of information he or she might use or look for in serving a client, negotiating a contract, defending government policy, or getting out of a difficult situation. In other words, you can present a student with still scenes, with written information, with different kinds of material so that he/she can begin to solve problems in the diversity of ways that humans do in real-life situations.

Another major advantage of interactive video is that, unlike regular video which is linear, interactive video is nonlinear. With nonlinear interactive videodisc and computer, you can move rapidly over 54,000 frames in two to five seconds. For language learning, the nonlinear branching capability has important implications. You can provide differential feedback to the student; you can adjust the next thing a student sees or the next thing a student attends to by where you take him or her on that disc. Lesson materials can be presented in accordance with the student's skills, learning strategies, and types of responses. Whereas most individualized learning programs can only adjust for pace, suddenly we can do much more. Although videodisc requires complex programming, it permits a wider variety of options than that known to date.

Still another advantage of interactive video is that it is fast. As I mentioned above, with a computer interface you can move anywhere on the disc in two to five seconds, depending on the kind of player that you have. Most other technologies do not permit rapid retrieval of information, and are relatively slow by comparison. The rapid-access capability of the videodisc is important pedagogically since there is no decline in attention and motivation or in the nature of the interactivity as there is with the linear technology such as video tape or computer-assisted instruction alone.

Furthermore, interactive videodisc comes closer to satisfying the demands of current learning theory which emphasizes the importance of student participation for learning. When using videodisc, the student must participate all the time, not just some of the time as when he/she is in a class.

Learning theory says that students learn best when they are solving problems, when their minds are active. With interactive videodisc we can promote problem-solving for foreign language students. Although other media and the classroom can help with the mechanics of language and pronunciation, students need to find themselves in unexpected communication situations and use what they know about the language to deal with these situations. No teacher can ever teach all of a language; you can only hope to teach the ability to transfer language learning to a variety of new situations. Interactive videodisc can give students the opportunity to use what they know to handle new social or professional communicative events and to deal with their own responses when incorrect. Classroom dialogue provides practice, but it is difficult for one native speaker teacher in the limited context of a classroom to really cover the range of unexpected new situations. A teacher just cannot do that consistently for all students and enable them to work out the solution that is most productive for themselves.

With interactive videodisc we can address student differences in individual preferences for modality of instruction. Students can find their own way of learning--how to best generate hypotheses, what kinds of associations they need for memory, what aspects of a social encounter or speech event must be heeded to make sense out of it. In all cases, interactive video offers immediate feedback so that the student can continue learning. Nothing is lost.

Interactive video can provide opportunities for students to do creative guesswork. With the disc we can begin to teach students to pay attention to clues in meaning present in the context of a video scene. However, unlike linear video where the clues are also available, with interactive video, the student can be shown how his/her choice could be improved.

Interactive videodisc allows a student to experience conversational exchanges in a "safe" setting, rather than in a real-life situation where native speakers may be judging his/her conversation. Videodisc is best used in natural conversational scenarios where the machine's next action is dependent on the student's response. Further, with interactive videodisc unlike computer-assisted instruction, we can help students come to terms with the fact that speech acts are often carried over several utterances. The videodisc lesson can help the student learn to maneuver through a speech event.

Constraints on Videodisc

Interactive videodisc is expensive to produce, especially if one fully exploits the interactive potential of this new technology. For a disc to be truly interactive, a new film should be produced so that the branching option, the alternatives, can be incorporated. It is possible to use existing film, but if the goal is to teach participation in a conversation, then a new film is required. Such films cannot be made by nonprofessionals. In a world of sophisticated television watchers and game players, films for interactive videodisc must be of high professional quality, and that requires a team of producers, editors, directors, a production studio, editing equipment and the like.

Development is complex and requires teamwork. To make a one-hour videodisc, you need an instructional designer who knows about language learning, a programmer who can use or adapt an existing program or write a new one, a scriptwriter, a television producer and director, and an editor who is used to the nonlinear qualities of the disc.

Another thing that adds to the cost of interactive video is that pre-testing is essential. Once you master a disc, you cannot change it. Mastering currently runs about $3,000; however, if you want to redo it you must start with production or editing costs again. It is essential to pre-test the disc.

It is my prognosis, although I'd be happy to learn otherwise, that chances for a decrease in the cost of producing an interactive videodisc seem limited since the major costs derive from the production and post-production editing process, as well as in the programming. Programming costs may be reduced by a good authoring system and eventually production costs may be brought down by computer-managed production, but still the costs are relatively high. Current real costs, not calculations based on contributed costs or contribution of researcher's time, run between $100,000 and $500,000 per hour of videodisc. Exciting as the technology is, we need to understand what the real costs are and consider when it is appropriate to use.

Is interactive videodisc a viable aid for foreign language teaching and learning? I think the answer is a definite "yes" under certain circumstances. One possible circumstance would be if a particular disc can be used by a sufficient number of learners, then the cost per disc becomes within range. Assuming that the disc costs $100,000, the low end of development costs, and that one could sell disc copies for $300 each, then one would need to be able to sell 333 discs to cover the development costs. This does not cover the cost of promotion or distribution of the disc. Also, since the disc can be used by several students in any one day, you may need several outlets to sell these 333 discs. The disc should appeal to a wide audience. It should address a topic of interest across languages so that more users would be identified. For example, if a disc taught language learning skills, it would be of utility across languages and therefore be of interest to many users. Or, if the disc addressed a language need which persists through time, it would be purchased on a continuous basis even though the number of users in any one year might not be as great.

Another possible application would be the case where the disc does something more effectively than any other means, and what it does is important enough to learners to merit the cost. That is, if the disc can provide a learner with an opportunity to acquire skills more effectively than he or she can do elsewhere, and the skills are important enough, then use of the disc can be cost-effective. In those situations where the ability to conduct conversations or interviews is critical, then interactive videodisc may prove to be the most effective means of training people to do this. There are many situations in business, in the foreign service, and in the military where the ability to react to new situations is vital; students need experience, before the fact, in learning to respond to these situations. As my colleague, Irene Thompson, head of the Russian Department, Foreign Service Institute, has said, one can teach the skills of riding a bicycle or driving a car in a classroom, but the student needs to encounter new combinations of demands on his/her skills. Interactive videodisc can provide this sort of experience quite nicely. The videodisc can provide full cultural, visual, and auditory contextual cues for important circumstances.

For some critical communication situations (using language under stress, in a disaster situation, or to negotiate requests require considerable skills and knowledge about expressing oneself in a culturally sensitive manner and interpreting intention which is couched in very subtle ways), interactive videodisc is ideally suited to training students to develop this sort of skill. Some of these skills can be practiced with teachers in the classroom but in no way can they provide the student with the kind of drill required to become skilled in these critical communication skills.

Finally, if interactive videodisc is relatively cheaper than any other training means available, it can be worth the cost. Let's look at an example from another sphere where this is clearly the case. If we consider the cost of training a pilot to fly a 747, then we can look at comparative costs. Training a pilot in an actual 747 can be quite expensive since you must consider the cost of gas, the trainer, and running a plane for several hours. Clearly, that is a very expensive way to train someone to fly this plane. The costs of running a simulator for each pilot are still pretty high, but they're cheaper. However, if some of the training can be done by an interactive videodisc, then although the development costs are high, they occur only once. After that there is virtually no cost of maintenance of the machinery. You do not have to have a trainer, and the disc is usable for more than one student. Not all aspects of pilot training can be effectively simulated by the videodisc, but it is likely that where it is effective, it offers quite a saving.

Similarly, in language learning, there can be situations where training is cheaper by interactive videodisc. Let us consider what kinds of situations there are where it is very important for a person to learn language skills and where the costs could be relatively cheaper. Some possibilities are: where the classroom or teacher is not immediately available to the student, or where the student's hours for study are erratic due to other professional commitments, or where the need for individual practice is urgent and the student already has some command of the mechanics of the language. In these cases, interactive videodisc training could be the cheapest way to go.

In conclusion, we can say that while interactive videodisc is a very important aid to the classroom, given the costs of production and development, disc production should be directed toward very specific learners, very specific learning needs, or toward very general language learning goals. I do not envision at this time an entire language learning course for beginners using interactive videodisc. Bork in 1981 said that videodisc is most valuable where real phenomena are essential for understanding the process.

Videodisc is an exciting unique supplement where knowledge about real phenomena is essential, where context is important as a clue to interpretation, and where the need for sensitive attention to expression and interpretation of intention is critical.

A COMPUTER-BASED LANGUAGE INSTRUCTION SYSTEM

LAWRENCE MARKOSIAN

Stanford University

The purpose of this project was to develop a computer-based language instruction system especially suited to the uncommonly-taught languages. In contrast to other computer-assisted language instruction courses, the computer was to be the principal medium of instruction rather than a supplement to traditional media such as lectures, texts, and language lab. The project was undertaken at the Institute for Mathematical Studies in the Social Sciences (IMSSS) at Stanford University and was directed by Professor Joseph Van Campen of the Stanford University Department of Slavic Languages.

Since the autumn quarter of the 1979-1980 academic year, a computer-based course in Beginning Western Armenian has been offered at Stanford University through the Linguistics Department. The Armenian language was selected for several reasons: the language was of research interest to the course developers; it had never been offered previously at Stanford and could not be offered because of the unavailability of instructors and the limited demand; and because of the dispersion of the Armenian population in this country and for other social reasons it appeared that the computer would be particularly well-suited to teaching the language. However, it is to be understood that the technical design of the instructional system is almost entirely language-independent; the same system could be used with different curricula to teach a wide variety of languages.

A principal component of the language instruction system is the curriculum, which is, of course, specific to Armenian. The curriculum consists of approximately 80 lessons, which present both expository material on Armenian grammar and vocabulary, and language drills. Both expository and drill lessons are worked interactively at a computer terminal which was specifically designed to display the non-Roman Armenian alphabet. Generally students average 50 minutes per lesson. The curriculum covers the usual topics in a first-year language course and includes a 1000-word vocabulary. The first-year Armenian curriculum was originally designed by Dr. Hasmig Seropian and was subsequently extensively revised by Van Campen with the assistance of Mr. Dikran Karagueuzian. Both Seropian and Karagueuzian are native speakers of Armenian.

A second curriculum consisting solely of drills was developed to accompany the widely-used book *A Textbook of Modern Western Armenian* by K. B. Bardakjian and R. W. Thomson. These drills cover more advanced material and lend themselves to use on simpler computer systems. These drills were developed by Van Campen and Karagueuzian, and represent an effort to make parts of the Armenian instructional system available on a wider basis.

Several programs have been developed at IMSSS which assist the curriculum author in developing language lessons. Among these are VOCAL, a curriculum author language and lesson compiler which allows the author good control over the video-display terminal and over student and computer interaction. VOCAL was originally developed for mathematics-oriented undergraduate curricula and was subsequently adapted to language courses.

An equally significant component of the authoring system is a language drill generator, developed by Van Campen. The drill generator allows the curriculum author to specify vocabulary, form, and pattern drill formats using the syntactic and semantic categories of the language being taught. The curriculum author thus does not create each instance of a drill by hand, but rather specifies general formats. Given a drill specification, the output of the program is dependent on the student's course position (vocabulary) at the time a particular drill is invoked. With the vocabulary available to the student by the completion of the VOCAL-based course and the text by Bardakjian and Thomson, there are over 4000 drill instances. This number can be increased simply by removing limitations on the number of instances allowed for each drill specification (limitations which were placed in effect to match the amount of time spent at the terminal in the Stanford Armenian course to university averages for other language courses).

Finally, the Stanford CBI language instructional system uses several methods of computer synthesis to produce high-quality English and Armenian speech. These methods are all based on linear prediction coding (LPC), which uses high-bit rate digital recordings by a native speaker of the language. From these digital recordings, the LPC algorithms allow a 2-order of magnitude reduction in bit rate, to approximately 3000-bits-per-second of spoken speech. The actual bit rate used for the Armenian course is somewhat higher (8000-bits-per-second) since the audio system was under development at the time and the highest levels of compression had not been achieved.

The work at Stanford University was done on a Digital Equipment Corporation (DEC) PDP-10 mainframe using the TENEX operating system. This configuration is very close to the current DECSYSTEM 20 and the programs (except for the Institute's speech system, which uses special hardware) can be transported to other such systems without great difficulty. In fact, some components of the language instruction system have already been adapted to 16-bit personal computers based on the MC68000 microprocessor, such as the Hewlett-Packard 9800 series workstation.

Using currently available speech-synthesis technology, it is technologically feasible to replicate the entire instructional system on powerful personal computers.

It is our belief that computer-assisted language instruction would benefit from recent work in areas of artificial intelligence, such as natural language understanding and intelligent systems. This work would carry computer-assisted language instruction beyond the rigid framework of syntax-oriented language drills which have confined most of the work to this point to relatively fixed types of student-machine interaction.

HIGH TECHNOLOGY, PRODUCTIVITY, AND TRAINING

THOMAS ARKWRIGHT

Lockheed Missiles and Space Company

Throughout the industrial age, managers have used capital expenditures to increase productivity. The execution of this strategy calls for managers to shuffle the deck of job tasks and deal new hands to people and machines. Productivity can rise as people stop doing tasks that new machines can handle. From the beginning, capital improvements have needed tactical support. Training has been the chief tactical support for productivity strategies that introduce new equipment and restructure jobs. Training is management's tool for quickly adapting employee attitudes and skills to new technology. We will examine some dramatic effects of training on productivity, and describe technological advances now being implemented which promise to favorably affect the quality and cost of training, as well as the productivity of enterprises.

In the past, training was absolutely devoid of glamour, and too often the administration of training was assigned to a junior personnel officer. Today, senior management faces the challenge of mobilizing training in support of capital strategy. This challenge is already receiving the attention of those senior managers and planners who understand training's pivotal impact on the acceptance and successful deployment of technology.

The importance of training has not always been fully appreciated by managers who are responsible for productivity. For example, a recently published list of the ways to boost productivity with a computer terminal overlooked the possibility of using a terminal to deliver training. A proper perspective on training begins with its importance as an aggregate economic activity--it accounts for over 10% of our gross national product.

While many individual organizations have training budgets in excess of a billion dollars, the tab for corporate and military training alone is many tens of billions of dollars. Given this level of effort, a casual attitude toward the effects of training on productivity or a casual attitude toward the productivity of training is inappropriate and suboptimal.

Why is all this money being spent? The need for training originates in staff turnover and in the evolving workplace. Employees' duties change. Capital outlays for equipment necessarily add critical new training requirements because new equipment shuffles people and their duties. Inescapably, plans for efficient, effective training should be a part of plans for equipment purchases.

Can organizations make equipment plans now and worry later about the effectiveness of training? Certainly, if that can be called planning. Consider the consequences. Unless productivity analysts and planners maximize returns from the training function, three unnecessary costs are incurred. First, employees will under-exploit equipment acquired through planned capital investments. Second, training inadequacies and inefficiencies will push back the break-even date for return on investment. Third, competitors who do understand the need for productive training will enjoy lower overhead because of the greater efficiencies in their training functions. These strong negative consequences should encourage planners to address training requirements and the quality of training in their plans for recapitalization.

The effects of poor training are now always confined within the corporation. As producers and servers sell more technology-based products, a capability for training one's own customers will become a more significant factor in sales growth. Currently, office equipment vendors are noticing the sales impact of their customer training capability. Incompetent training by vendors may prod some to start sometimes costly, always visible, lawsuits.

Too few private and public sector leaders view workplace training as a priority that will help us project our nation's productivity, stability,and wealth into the future. Today's productivity strategists--our senior managers--almost never directly control training. Nor do they normally perceive training as a significant variable in the productivity equation. Too often delegation of training guarantees that middle managers will sacrifice training to short-term operational requirements. A particularly shortsighted example is a recent trend among data processing managers to cut their training budgets, in spite of generally high turnover, and in the face of constant technical changes.

Unless training for the nation's workforce becomes a priority for our leaders, unless new training technology is used to recycle the workforce, technology-induced obsolescence will abruptly and gradually overtake large segments of our workforce. To the extent that training offsets welfare and worker shortages, it can resolve the political and economic pressures which are being set in motion by the growth of automation. Fortunately, private and public sector leaders of considerable stature, such as James D. Robinson III of American Express Company and Lt Gen Stansberry of the United States Air Force, have begun calling attention to the training issue.

Managers wanting to optimize training have sought training advances over the years. "Self-paced" instruction has been a big help, where it could be made to stick, saving 25% of class time without equipment outlays. Computer-based instruction has also helped, especially in areas such as flight training, where software and hardware investments are offset by lowered risks and by nonuse of real equipment. Currently, falling computing costs are suggesting new possibilities based on the "distributed intelligence" model that has already been applied successfully to computer terminals, networks and processors.

Over half the training costs in industry and in the military come from carrying the learner to the training--travel, salaried time away from the job, and fixed costs of a residential training facility. Dramatic savings can be achieved by carrying training to the learner. This less costly approach is called "decentralized training." Decentralization encourages self-paced and/or computer-based approaches to training, which shorten training time.

The Department of Defense has often stressed the benefits of reducing the amount of training carried out in residential facilities. While decentralization does not always eliminate residential training, it does shift more course time to the workplace. Industry, conscious of the need to cut training costs, is also working toward decentralization. Among the difficulties in converting to decentralized training are geographical distance, and disruptions of existing instructor-learner contacts. Recent developments in high technology promise to reduce these obstacles.

The starting point for decentralization is a specialized, low-cost portable tutor. Designs for silicon tutors incorporating a series of breakthroughs are already being simulated. Ultimately, the silicon tutor will look like a calculator, and will incorporate many classic features of computer-based training. The device will administer tests and drills, select items according to response correctness, give feedback and advice, record response time, control videodisc displays when these are needed, and automate transmission of test scores to student records archives. This fully-independent "pocket" tutor can be armed with enough artificial intelligence or knowledge to avoid the slow and costly "authoring" process of encoding course materials in computer instructions. It will get the programmer out of the training picture, and hand over control of the technology to the instructor.

Independent, specialized simulators, based in reprogrammable classroom computers, can be used simultaneously with silicon tutors. A silicon tutor will control a learner's progress through the training activity, while classroom computers may be available nearby to do specialized demonstrations and simulations. The new silicon tutors also can be used as "presimulators," introducing panel layouts, terminology, relationships, and concepts before the learner starts using a more costly specialized simulator. The objectives of a presimulator are to use scarce simulator time more efficiently, to ensure uniformity of learners' skills and knowledge before simulator training begins, and to reduce one-on-one instruction.

Importantly, the new silicon tutors will perform the three most frequent, time-consuming training activities--presentation of material, drills, and tests. Without these tutors, today's instructor uses large blocks of time to administer group drills and tests. This drillmaster approach may submerge individual learner's questions out of consideration for the whole class, generating confusion which in turn slows down the group. When silicon tutors deliver drills and tests, learners will get frequent, regular feedback from their own tutors, and the instructor will be able to focus attention on the individuals who will benefit most. Instructors will have more time in the silicon tutor environment to work with slower learners, analyze performance, and manage each student's progress. The net effect will be to increase the ability of learners to work independently of instructors, setting the stage for an eventual geographical separation of instructor and learner under decentralization.

While silicon tutors can shorten training time and reduce the dependence of learners upon instructors, the increased timely feedback and advice to learners that the tutors will make possible increase the value and relevance of contacts between instructors and learners. Once learners stop learning as a group at the speed of the class, many individuals will finish a course faster and training costs, including nonproductive salary outlays for trainees, will decrease. These positive impacts on training productivity will make silicon tutors economically attractive in their own right. They are also a means to the larger goal of decentralization.

Decentralization, the big jackpot in training productivity, comes within reach once the silicon tutor has been available to relax the interdependence of the instructor and the learner. The next step is to use an electronic connection fashioned from communications technology to unite the tutor-equipped learner in the field with an instructor in a central administrative training site.

Satellite-based communications are cutting the costs of the electronic connection, which may handle data, voice, and video. Not every organization will need voice and video at the outset, so we treat data, voice, and video as independent capabilities. First, there must be a capability for sending drill and test results from the learner's silicon tutor to a centralized administrative computer from virtually any location. A common device which can transmit this data is the microcomputer. The learner, after completing a drill or test on a portable tutor, would transmit data in the tutor--the learner's name, lesson number, responses, response times, etc. to the field unit's microcomputer. This data would be routed by phone lines, microwave or radio to a central administrative computer for storage, and therefore would be instantly available to instructors in the central administrative training center. Once this data was evaluated, an instructor could transmit a selected list of new training activities to the field unit's microcomputer for inspection by the trainee. In some cases, this data and message transmission capability could be increased to permit transmission of facsimiles of pictures and notes. A voice link between far-flung learners and their instructors in the central facility would be useful for questions, motivating and reassuring learners, and other such uses. Telephone conversations are not ideal for reporting scores because the silicon tutor's detailed, item-by-item record of learner activity would be lost for later analysis. Note that the administrative computer would have the ability to regulate training schedules, which would enable organizations to keep their planned balance between ongoing duties and training requirements.

The final specialized communications capability needed for decentralization of training is two-way video between the instructor at the central administrative training site and the trainee in the field unit. One version of two-way video is today's relatively costly video conference. Two-way video will enable tutorial contacts between a learner and an instructor. These instructor-learner contacts may be needed for explanation of special cases, remediation, traditional tutoring, and for some testing, as in tests of a learner's foreign language speaking skills. Cheaper variants of full-blown teleconferencing will also have a role to play, including cable television to deliver selected materials, and including one-way slow-scan video, perhaps to illustrate new repair procedures, or ongoing lab experiments.

Publishers will benefit from the opportunities in this emerging training environment. The costs, complexities and uncertainties of embedding courses in software will be reduced. Publishers foresee tremendous growth in the industrial and military training markets as tens of millions of workers adjust to the impacts of automation on their jobs. Publishers will be able to produce a course and deliver it to a massive, far-flung audience, perhaps in association with accredited institutions that will house the necessary equipment, and draw their students from industry and the military. The challenge to publishers competing in this new market will be to create course materials that clearly capitalize on the power of silicon tutors, the advent of decentralization, and the desire of mature learners to acquire new marketable skills without wasting time and effort.

Employers, on the other hand, will look beyond the traditional training goal of developing the minimal skills needed on the job. The traditional goal does not develop an employee who will creatively seek new ways to further improve productivity. Richard, later Sir Richard, Arkwright learned this lesson over 200 years ago, as the factory system was getting underway. His mill at Chorley was obliterated by his carefully trained equipment operators, who were unaccustomed to the ceaseless diligence demanded by the new machinery Arkwright developed to process cotton.

The productivity of training is rising to meet the challenge of automation and the demands of productivity-oriented managers. New training equipment, increased managerial focus on training, and amplified publisher capabilities will come together in the near future to support the productivity of organizations. The availability of silicon tutors can now be planned for, and the cost of interactive video transmissions and facilities will become acceptable in this decade. Organizations that plan fully for their futures will factor the merging high technology for training into their productivity planning process.

ERGONOMIC INPUT

MARK RICHARD-FOGG

Marc Fogg Software

I'm going to talk about ergonomics of computer usage, the man-machine interface. Those of you who are familiar with computing know that it can be very difficult sometimes to learn a new system or to refamiliarize yourself with an older system. Those of you who haven't used computers may realize that it's very difficult to begin to learn to use it. I'm a designer and an inventor, among other things, and I will show you some reasons for this difficulty. I'm going to give you a history of where the terminal and computer-man interface that exists now came from and where I'd like to see it go and where I'm personally taking it.

The design of the instrument that you see, the CRT and terminal that everyone uses, is originally from the typewriter, which is a late eighteenth century, nineteenth century invention. As long as one is sitting upright and has a limited time to use it, then it's fairly comfortable to use. This is not the case for longer periods, as my experience shows me; I work about eight or 10 hours a day behind one of them, and I tend to go into extreme slouch. The first innovation that people made to address this problem was to separate the keyboard from the console; however, the problem area with this basic generation of devices is operator fatigue. For instance, if you're working from a piece of paper and on a screen, then you have to constantly shift your attention. It becomes very difficult to do it for a great period of time.

Actual computer operation is so difficult that I call it esoteric input. You must learn the specific vocabulary of the command language of a computer in order to operate it. It is important to differentiate between computer operation and computer use. An efficiently designed program should allow a computer user to have access to all the facilities of a computer system that the designer deems appropriate to that program's use. In order to create that efficient design, however, the nuance of several levels of command language must first be mastered. One technique for overcoming this is a fault-tolerant operating system based loosely on artificial intelligence practices. One such system recognizes the intent of the user instead of having to know the exact grammatical structure to tell the computer what to do. The program recognizes certain words and puts together a logical guess. Usually accurately, since the command grammar of such a system is necessarily simple. Since it then works with a few mistakes on input, speed is very much increased and frustration reduced.

The touch screen terminal, which I have brought to show you today, allows phrase recognition to operate the command systems.

One must still know something about the operation of the machine to make sense of the phrases, but even a vague recognition is enough to begin using the most arcane functions of the machine, certainly not the case with any other system. The English language may be used in the phrases or any French, German, or Chinese language phrases may be substituted with equal ease. Iconographs may also be used (pictures used as signs). The current proliferation of instructional signs, for instance "No Parking," "Drinking Fountain," or figures to represent rest rooms, make the use of such icons an accessible alternative to words. The substitutions of recognition rather than esoteric knowledge and icons rather than words give us the first clear break from the nineteenth century mechanical matrix-word relationship device...the typewriter. Upon recognition, the user may choose among all available functions provided by touching the appropriate item with a fingertip. Esoteric command languages are still necessary for the designer who needs to come up with the English or Chinese phrases, but a good guess is that a more natural structure will be adopted by manufacturers. I hope.

Currently mechanisms are available to make computer use less fatiguing. There are many devices which will adjust the viewing angle of the terminal screen to a comfortable eye-height position. That terminal and this blackboard each have a great range of adjustment, which is completely ignored in that Apple over there in the corner, which has a very strict and limited eye-to-hand relationship. I've done some things with new designs that give them a much greater range of movement. A current commercial design which is close to that utility is the Wang Pro Comp, which has a long arm attached to the bottom of the screen so that it may move in a-foot-and-a-half radius, very useful in combating fatigue and boredom. The European Society of Engineers has a new standard of relationships that requires a certain range of adjustment and anti-glare measures.

Foreign language instruction applications of computers are especially challenging since a student must learn how to operate the computer before the instructional program may be of use.

Interactive videodiscs and touch recognition technology allow a vast array of information to be accessed while using icons alone. One would expect the utility of such a system to benefit from the more natural relationship of eye and hand.

Chinese and Japanese both have a huge number of characters. So many that a keyboard must have around 10,000 characters to be adequate. A recognition system using touch identifiers and partial-character icons would obviate the need for a 10,000-character keyboard, and make it possible for input by untrained individuals.

Speech input and output is the next step in computer utility. We may believe if we choose, that within five or 10 years, the myriad of problems associated with speech will be solved, and such primitive methods as poking a screen with one's finger will be obsolete. The state of today's art of speech recognition is acceptable in very limited circumstances. My demonstration for today was to have included a speech input and output device, but it's very cranky and is currently awaiting repairs. The device recognizes one word among thirty that it has been trained to recognize by repeated speaking into its microphone. A primitive adaptation of pattern recognition fuels this speech engine; basically a mathematical picture of the phrase to be recognized is computed with the current map of all such pictures in its memory. Like everything else, it needs more memory and faster processing to improve, and, fortunately, this is a time when both are sure to be available "next week." Foreign language instruction would benefit greatly from this technology. Besides infinite repetition of the sort now available with tape in language labs, the student in the time of speech recognition would be able to compare a frequency analysis or phoneme analysis in real time with that of that native speaker. Imagine if you will, several graphs and charts of speech characteristics, as the native speaker intones "Mary had a little lamb, a little toast, a little jam," the graphs twitch and jump. Then the student tries and sees a set of parallel charts which compare with the native speaker's. "More glottal stop," the machine might intone while highlighting the appropriate graph and time element.

My demonstration today is a wine manufacturing software system, which I have developed. An algorithm of the winemaking process, and my abiding concern for the last couple of years. It demonstrates all of the various features that are available when using an English (or other) language system instead of a computer language system. In other words, it uses the intelligence of the computer to obviate the need for learning about the computer. Since there are closer to one hundred and fifty than the thirty I was lead to believe might be here, I will demonstrate the system at the end of the session.

TEACHING THE RECEPTIVE SKILLS

DAVID WYATT

American Language Academy

The use of computers in language teaching is still a highly controversial subject within our profession. However, it's important to remember that all of the common objections to computer-assisted instruction or to computer-based instruction do not apply at all to a sizable area of language learning--the receptive skills. In fact, reading and listening not only lend themselves ideally to computer implementation, but they're demonstrably difficult to teach adequately through traditional classroom techniques.

By their very nature, the receptive skills are highly individual and idiosyncratic. For both reading and listening, comprehension speeds and abilities vary enormously among students in the same class at the same level. For example, whatever average speed of presentation is selected by the instructor for a traditional classroom listening activity, it will be too slow for some students, not challenging and developing their skills as it should, while it will be frustratingly rapid and beyond the abilities of the less-able students. An individualized approach involving the computer has tremendous potential in this and many other areas of the teaching of the receptive skills.

To illustrate the argument in more concrete terms, we'll first examine three typical, highly specific examples of instruction in different aspects of reading.

The major focus of many modern reading courses in English as a Second Language (ESL) is the development of a body of reading abilities, skills, or techniques which have been increasingly well-identified in recent years. Courses such as "Reader's Choice," "Essentials of International Trade," and "Reading and Thinking in English," and many others have been based on syllabuses which include practical reading strategies such as skimming and context-guessing; general discourse speeches such as anaphoric reference and paragraph main ideas; and specific language features such as the notions of cause-and-effect and/or functions like classification and definition.

In order to demonstrate what I'm referring to, I have a handout which has a more detailed listing of these three divisions of reading skills than I will be able to go into today. On page 1, you will see that I have listed the first category of reading skills as they are commonly interpreted in English as a Second Language. That is, the Practical Reading Strategies. You will see that the first page covers such things as reading according to purpose. Under that division, for example, I have five main teaching points or techniques:

(1) scanning--reading rapidly for single, well-defined pieces of information; (2) skimming--reading rapidly to detect main ideas; (3) surveying--which involves the approach to reading including a sort of preview; (4) receptive reading; and(5) critical reading. I've also included examples of handling problems that you may encounter in reading and using reading aids. If we could have the first transparency, please, just to give you a more concrete example of actual exercise material dealing with handling problems. That is, the practical reading strategies. Here are some examples of ways of approaching complex sentences without breaking down completely into tears if you don't understand all of the vocabulary involved. There are practical ways of approaching difficult reading material in order to elucidate the meaning. So these are examples of the practical reading strategies that I'm talking about.

On page 2, I've listed General Discourse Features. Readers in a second, third, or fourth language need to be aware of the general features that you find when dealing with discourse. On that page I've listed things such as the reference of pronouns. This is frequently a very difficult problem, even for advanced level readers in a second language. They don't have a clear idea of what pronouns like "their" or "this problem" refer to. Synonymous expressions often cause trouble. For the sake of variety, or for other rhetorical purposes, writers often included synonyms, synonymous expressions. The student has to be able to deduce whether the writer is indeed referring to exactly the same concepts with a different label or whether in fact the linguistic labels have different references. And I've listed other examples of general discourse features which have been found to be important in teaching reading in English as a Second Language: things like connectives; locating the main idea of a paragraph or larger discourse section, an entire reading passage for example; understanding the logical structure of a paragraph or a higher level text such as an entire reading passage; and finding the communicative function of a sentence, paragraph, or passage; to be able to detect the wood as well as the trees, as well as all the linguistic information; to be able to pull out these functions and purposes. So these are general discourse features which are frequently important items in a syllabus of reading skills.

On page 3, I've listed Specific Language Features: notions such as cause-and-effect and their associated vocabulary connectives and syntax; functions such as classification and process description. Particularly important are things like connectives, which are clear signals when you're reading in a second language of the logical organization of sentences, paragraphs, and higher-level discourse sections.

The main difference between General Discourse Features and Specific Language Features, when you're approaching the teaching of reading, is that when you're teaching specific language features you have a well-defined syllabus of the whole range of functions which are important in discourse of the type that you are teaching--classification, process description, comparison, contrast, et cetera. When you are teaching specific language features, you have an entire syllabus in your mind, rather than making students generally aware that they must look for notions, functions, and connectives.

So this is a very brief overview of what is perhaps the major modern approach to the teaching of reading skills, at least in English as a Second Language. And I'm sure those of you from the foreign language teaching community will recognize many of these skills and techniques as the ones which you also teach. Teaching points of these types in a modern ESL course are generally presented and practiced individually, in isolation where possible, before being encountered in longer, higher-level reading passages. With this approach in mind, let's look at the three specific situations that I mentioned.

As a first specific situation, consider a traditional classroom in which the student's ability to recognize and understand the important organizational function of classification is being developed. Let's suppose as part of this process, the teacher is using a textbook which presents five paragraphs of the type that you will see in the next transparency. We're talking about the function of classification, and obviously, in reading technical English as well as in other areas of academic reading materials, classification is an extremely important form of rhetorical organization. So the teacher is presenting five paragraphs of this type in a traditional classroom. He might pause to discuss each one in turn after allowing time for the students to complete each exercise. The limitations of this traditional classroom approach and the print medium now become very obvious. Some students will typically have mastered the teaching points after only one or two of these five exercises. Indeed, they may immediately recognize the skill that's involved and may not actually need to do any of these exercises in great detail. On the other hand, some students will require practice with much more than the five exercises and an opportunity to work at their own pace with those exercises in order to develop the necessary mastery of the teaching points. The situation virtually demands an individualized teaching methodology.

On closer examination of the classification exercise, another important problem becomes apparent. Suppose you're doing this exercise and make a mistake at the very top of this classification tree. The remaining decisions that you make during this exercise are going to be rendered difficult, or even impossible or meaningless, by an early mistake. In a traditional classroom, the teacher would wait until this particular exercise at least was completed before checking students' answers. The exercise would be much improved by an immediate rejection of the wrong answer, followed by the chance to try that particular answer again, at least for those students who are going to make early mistakes. This technique is typically, almost inherently, employed in computerized materials.

Within the print medium, recognition of the need for individualization led some years ago to the evoluation of reading labs, such as those of Science Research Associates, the well-known SRA Reading Laboratories, for both native speakers and students of English as a Second Language. Potentially, however, the effectiveness of these materials could be vastly increased if the presentation of exercises and the class management chores (such as testing and placement) were handled by computer.

As a second concrete situation, consider a course segment in a traditional print medium which is designed to increase students' reading speeds. In a textbook such as Harris' *Reading Improvement Exercises for Students of English as a Second Language*, a well-known textbook in ESL, typical objectives might be to develop the ability to read in meaningful word groups and to grasp those word groups with a single eye fixation as a means to faster, more fluent reading. I'm sure you're all familiar with the problem of students who insist on reading word by word, in fact almost deciphering a text or reading passage word by word. The great drawback to this method, apart from its slowness, is that, if you're dealing with a group of languages which must be comprehended as a whole, by the time you get to the end of the meaningful group, the memory of the words deciphered at the beginning of this meaningful group is already fading. It's very difficult in fact to get the full meaning out of the text if you read it word by word. The textbook that I referred to is a traditional print textbook, published around 1963.

Excellent as the approach is in this book, the limitations of the print medium again become dramatically obvious. Within a given page of material presented to the student, there is little or no effective way to control what the student sees with his eyes and what he does thereafter. Now suppose we want him to read in meaningful word groups; how do we force him to do that? Even if we present the student with meaningful word groups on different lines, rather than sentences running across the page as they normally do, there's absolutely nothing to stop the student from reading the first line word by word. This had led to a generation of educational technology such as the tachistoscope, which at best is clumsy, expensive, and a minor advance over print.

Using computers, however, the instructor can exert complete and highly flexible control over what the student sees on the screen. For example, single words can be presented; they can be presented anywhere on the screen that the materials developer desires. A line of words, a meaningful group of words, can be presented far too rapidly for a student to read them word by word, and then removed again from the screen. There's tremendous flexibility and control inherent in even the simplest computer and video display unit combination. Of course, all the other advantages of computerized materials, such as continuous monitoring of student performance and adaptive branching to higher or lower levels of difficulty based upon this, are also available.

For the third specific situation, consider any reading exercises assigned for out-of-class study. It is rare indeed for answers to be provided with such assignments; so it is usually the next day at the earliest before the students receive any information as to the acceptability of their answers on their reading assignment. It seems clear that a very large part of the pedagogical value of such homework must be lost. Wherever the informative feedback, whether the answer is right or wrong, is delayed for such long periods, the educational value of the presentation must seriously be doubted. Whenever computerization is appropriate, the advantages of CAI in terms of immediate, informative feedback alone seem to represent a considerable advance over traditional media.

Given the outstanding potential of computerized reading course segments, what computer hardware is needed for their implementation? Work in progress at the American Language Academy and in many other locations seems to demonstrate that, as far as computer-assisted instruction is concerned, relatively inexpensive microcomputer systems are quite adequate for the tasks. At the American Language Academy, we are using the very basic system for our student terminals: Apple II microcomputers, single disk drives, and color video monitors. You can save an appreciable amount of money by going with a black-and-white or a green-screen monitor. So for computer-assisted instruction to be feasible in this type of reading skills material, all the evidence seems to indicate that a very basic CAI system, a microcomputer system, is quite adequate.

As described in a recent edition of *English for Specific Purposes*, all that's required is a learning center containing a number of these independent microcomputer systems, a number appropriate to student body size and instructional intent. One potential major drawback in terms of reading materials is the relatively small amount of text displayable with these inexpensive microcomputer systems and video display units. But this is an obstacle which can be largely overcome by presenting lengthier reading materials in print booklets and displaying the exercise material on the screen. More powerful computers, video monitors, and networking capabilities may be required for extensive computer-based instruction, however.

In a typical CAI reading lab in our computer learning center, the student has a personal diskette which maintains a continuous record of his work and scores so far. To start up the unit, he simply inserts the diskette in the single disk drive and turns a single switch which controls all of the power to the computer and to the video display unit. From then on, the operation of the system is entirely automatic so that the student has very little knowledge of how the computer system works. In fact, it typically takes about a 15-minute introduction for the student to become fully conversant with how to use the CAI materials. The equivalent learning time for one of our instructors is usually about 30 minutes. Students pick up the approach and the way in which to use the materials much more rapidly than the average instructor. It's really a very simple operation, deliberately designed to be so. The student starts up with his personal diskette, and this is how his position in the course is entered into the computer. From then on, he can decide to work with new material (in which case he will be automatically routed to the correct point in the course), or he can review anything that he has done so far. If he tries to beat the system by putting in a more advanced diskette and pressing the REVIEW button or pressing the MOVE TO A NEW EXERCISE button, then he's politely told that he's not ready yet for this diskette, to please choose the appropriate diskette at a lower level in the course.

Presentation and practice activities are closely integrated with what he has been doing with the traditional textbook in his regular class. The ratio of time spent on CAI to time spent in the traditional classroom, in our implementation at the moment, is about four hours of traditional class, one hour of scheduled time in the CAI learning center, and then anything from two to six hours put in by the student on his own time, at a time of his own choosing. As I mentioned, presentation and practice activities are closely integrated with what he's been doing in the traditional class. Basically what's happening is that he's being given the opportunity to master those materials or to extend his knowledge in new directions. There is continuous score-recording, and for our course development purposes, there is also recording of the answer the student gave, so that we can go back and investigate the effectiveness of those exercises in terms of the results achieved by the better and the poorer students. And we can be sure that the exercises are doing what we intend them to do. The scores for the current session have been continuously retained in memory; when the student decides to exit, he is reminded to put his personal diskette back into the system and press the RETURN key, at which point his scores for the current session are recorded on his personal diskette. This is how we manage to operate with a single disk drive for score-recording. There is a very great motivating factor in terms of the student's obeying that reminder to put in his personal diskette and press RETURN; he receives no credit whatsoever for his work during the current session on the computer if he ignores that instruction. Of course, he doesn't know anything about how those scores are being recorded on the diskette; that's completely automatic. All we do is remind him that it is necessary to do that.

Very similar considerations to the ones that I've been discussing apply in the case of the other receptive skill, listening. Extensive work has been done here, but the main limitation of its implementation site--the language lab--is this non-interactive nature of the language lab, which is an extremely serious drawback. Individualized, self-paced, and truly interactive listening skills material would represent a tremendous advance. A cost-effective solution would potentially be available for listening skills in the form of microcomputers and courseware combined with traditional audio tapes under student or computer control. However, in this case the future clearly lies with interactive videodisc systems through which a rich extra-linguistic visual context can be provided together with the audio materials.

TEMPLATE OR FREE-FORM SYSTEMS? A LOOK AT THE ISSUES

GLYN HOLMES

University of Western Ontario

The aim of this presentation is to examine template systems and free-form systems. I don't think I'm telling anybody anything they don't already know when I say that computer-assisted language learning--not just computer-assisted, but video-assisted, interactive video-assisted learning--has a basic problem which may or may not ever be solved: the creation of sufficient quality courseware in sufficient quantity. Without that, educational technology may just die, if it is not already dying. Some of it already has. How many of us have got language labs that have fallen into disuse? So little courseware in actual fact exists, as I'm sure a lot of us are aware. So the big problem confronting us--or one of them--is how do we get this courseware? How do we keep it quality courseware and how are we going to turn it out quickly enough?

What I would briefly like to examine today is two possible ways of doing that. One is the template system, which one can call an authoring system, and the other is a free-form system. A template system is defined very simply as a system of computer programs enabling a course writer, who could be a language teacher, to create lessons without having to do any programming. To a lot of us that's very appealing. A free-form system, on the other hand, means that you start from scratch and program everything from scratch. You are acting as a computer programmer. So what I would like to do today, with the help of a few overheads, is to examine three template systems created by language teachers. One of them is done by Graham Davis, a teacher of German in England. One of them is a teacher of Russian at USC in Los Angeles, and another is a colleague of mine, a professor of Spanish and Italian at the University of Western Ontario, who is a total computer nut, as he probably has to be to do what he did. Anyway I'll let you judge yourselves.

The free-form system that I'd like you to have a brief look at is our own. The acronym for our project is CLEF, "Computer-Assisted Learning Exercises for French." I have no difficulty remembering that fortunately. What I'd like to do is to examine these systems from three perspectives. One is the presentation of information, because most lessons contain presentation of information. The other perspective is the analysis of student input: what you do with the input once it's typed in. The third one is feedback: what kind of feedback do these systems allow you to present to the student?

SLIDE 1 This one is TEACHER'S TOOL KIT by Graham Davies. With this particular system he has already created a series of German programs called APFELDEUTSCH which of course runs on an Apple. This particular template system that he used to create these lessons is called TEACHER'S TOOL KIT and it's available on Commodore PET or Apple II.

The presentation: what information can you present with this system? Davies allows up to three frames within the usual 30x20 character matrix. What type of question formats will the system allow? Well, he allows you eight lines to work it out yourself. Hence, you can have multiple choice; you can have fill-in-the-blank. I suppose you could have a text with a fill-in-the-blank or whatever, up to eight lines. But let me tell you something that Graham says in his handbook. He says, and I quote: "Large amounts of text on screen are generally indigestible." And I quote further, "It's inadvisable to present page after page of screen information to the learner. Better to refer him to a printed source." So, of course, that's the way Graham's system is set up. Hence, what Graham is doing is virtually dismissing the computer as a source of information to the student. This already limits his system.

What can he do with student analysis? What kind of an analysis system does he have? String-matching. It matches the answer against the input to see if the string is correct. He does have a provision for a one-character typo error. You can have up to eight alternate correct answers, and you do have the option of eliminating the caps and the spaces if you wish. The feedback, which of course is linked to the analysis, is that it will basically tell you whether your answer is right or wrong. If it's a typo, it will in actual fact go in reverse-video. That one character will go in reverse and will allow you to try again. You do have one little help feature: you have the possibility--and it's the course writer who decides this--of showing the student the shape of the answer by a series of asterisks corresponding to the number of characters in the answer. The student can have that as a help feature, but it is at the discretion of the course writer. I won't draw conclusions on this system until I'm done with all three.

SLIDE 2 This is a system which I had the privilege of seeing at the University of Southern California last March. The day I arrived, or the day after I arrived, it became obsolete because they improved it. They came up with a new one which I will mention very briefly later on. However, that doesn't mean I can't talk about this particular system now because the exercises are implemented right now. The system is an IBM minicomputer, which not too many of us have unless you've got the $100,000 that USC happened to have lying around. The presentation of information on this particular system is a blank-screen format, as I suppose was Graham's too. Within this blank-screen format the course writer can type in whatever he wishes within a limitless number of screens. Now while I was there I did not in actual fact see any graphic characters on any information screens. In point of fact, I saw very, very few screens of information on the lessons that I saw for both German and Spanish. The exercise formats are pretty much the same. You have a blank screen to work with, and you can put whatever exercise in whatever configuration you wish. I must give credit where it is due. The two graduate students, one Spanish and one German, who were using this system, have come up with some beautiful formats. One was even a crossword on a screen, which was the first time I had ever seen a computerized foreign language crossword. But it looked very, very nice. These graduate students were actually developing skills in visual design which should be, ought to be, will be, an aspect of many CAI lessons. Certainly we saw that with the TICCIT German this morning.

The analysis on this particular system analyzed all the input on the screen at once. You could have limitless numbers of fill-in-the-blanks, but they were all analyzed at the same time. It was totally a character-by-character match. This did not include provision of missed spaces, as I recall it. It was character-by-character match, but it could ignore capitals. Feedback in this particular template system was that the correct characters would remain on the screen and the incorrect characters would be replaced by slashes. A relatively simple, relatively unsophisticated system, although it was very beautifully engineered. But in point of fact, the students did not really find this kind of limited feedback too much of an impediment to learning what they were supposed to learn. So credit to Ed Purcell for doing that.

SLIDE 3 The third template system is one being developed by a colleague who took a PET to Italy for a year in a garret and played with his PET all year. Without his wife, too. He left her at home. As I said, a total computer nut. He's still developing the system, but I would like to do some PR for him and tell you the kinds of features that he is going to be including in this more sophisticated, state-of-the-art template system for the Commodore PET.

What he's doing in the way of presentation of information is: he's not even bothering to include a feature allowing you to actually display information. He's not even bothering with it, which is an indication of something. But for exercise formats, he has a series of different exercise templates which correspond to what he thinks are the major kinds of linguistic drill-and-practice exercises.

SLIDE 4 Very briefly his template formats are these. He has what he calls a single-cue frame. The top of the screen here, this is where the information is displayed to the student and comments appear. This is actually the exercise or the drill, the linguistic material that the student is working with. So here is a simple multiple-choice format, which can also be used single-cue, meaning just one cue at a time here. They can also be fill-in-the-blank, at the discretion of the teacher. That's his multiple-choice, constructed response: all within that one particular template of a single-cue frame.

SLIDE 5 Another template that he has is a transform frame. In other words, a student has to transform everything that is blocked in there into, for example, the past tense, since the stimulus would be hier as opposed to aujourd'hui. The template would jump the cursor from one space to the next. Another template is a multi-cue frame, which means the student first of all chooses which verb--for example--he wishes to use. He will choose by pressing the plus key, which will make the cursor go down the list of possibilities. He will choose the verb that he wants to use. The second part would be then typing in the appropriate verb form. So he chooses from a multi-cue stimulus.

Three more templates that he has are exactly the same as the three I've just mentioned, but what he calls scrolling templates. These are all--or at least the other two we're dealing basically with--a single sentence. He's devising a scrolling frame template which will allow you to work with a text that scrolls up. So all those three will be modified by a scrolling effect to deal with a text.

Another template which he mentioned is what he calls a soft-scroll template. What he is doing here is dealing with a cloze test, and what he means by a soft-cloze scroll is that the course writer will be able to choose, from within a given text, to eliminate every nth word. He can eliminate every third, every fifth, every sixth word. Plus he's got a further option of being able to eliminate any articles within a text or any adverbs within a text. This, of course, is obviously going to require that the course writer tag each word in his text according to a grammatical category. A little more complex, but then the result is a little more sophisticated.

SLIDE 6 The final template that he's devised at the moment--and I hope he didn't do anymore yet--is his construction set: building blocks. I think it's reasonably self-explanatory. You simply have to construct a sentence from a list of possibilities.

SLIDE 7 What kind of an analysis is he going to do? Now this is the one of the three template systems we are considering which is specifically designed for language study. Graham's and Ed's were designed for anybody, any subject. This one is specifically for language, and therefore can probably allow itself to be just that little bit more particular or picky. Wolfram has a series of routines which will pick out specific errors: one letter wrong, one letter short, one letter too many, a double letter instead of a single--in Italian he tells me this is far more common than in any other language. I suppose it's slanted towards Italian and we'll not bear him a grudge for that--single instead of a double, or two letters transposed. Now the feedback, of course, is linked to this. If it's a question of a character or a space missing, it will insert a space in reverse-video. If it's a letter too much, it will drop the thing off the bottom of the screen. Very nice effect, dynamic! Letters reversed: if he's got two letters reversed, it's a simple operation for a micro to put them back in their proper place. Or if it's none of those things, all templates will simply roll back the input to the last correct character and let the student continue typing from there.

Wolfram has some nice help features in a constructed-response exercise format. The student can, upon demand, go into a multiple-choice; if the constructed response is too difficult, then he can request a multiple-choice format. He can request a pattern match, the same as in Graham's, and I suppose the same as in Ed Purcell's system. And then another very nice little feature which he's thought of, and works tremendously well, is that the student can request, one character at a time, the correct answer, and stop it and continue his own input at any time. The last little feature which only Wolfram could have thought about was the choice of social registers. He's not happy with a computer that speaks one language; he's designing a character set which will handle just about everything including Russian. But not just a question of languages, he deals with social registers. He is going to give the student the option of requesting feedback in particular social registers. So one student who is a rather snooty student may get *Je suis désolé, Monsieur Doe*, by way of feedback. Or *Il est permis de se tromper*, something like that. To another one who is a bit more of a with-it guy, his feedback will be *Ah, zut alors!* or *Où as-tu appris a parler*? or *Un autre coup raté!* or something like that.

Those are the template systems that I am very familiar with. What kind of conclusions can we come to? Firstly, they have limited use as a presenter of information. Graham even advised against it--wrongly I think, as I think was amply demonstrated by the TICCIT program this morning, which I was delighted to see. There's been some very imaginative visual methods of presenting information and Professor Jones may have thought that his A with an arrow and his D with a dot were pretty poor stuff. I thought it was brilliant in its conception. The one thing we can say about all templates systems, and I'll emphasize this in a second, is that they are all static. Frames. They don't do anything. They're static. The exercise formats seem to be becoming more and more varied and sophisticated. And what about the analysis? They all have a single approach. It's the one I call a word-processing approach, based on character- or string-matching. I don't mean this in any pejorative sense, but it is a "meaning-less" way of handling input because it does not consider the meaning of the student input. But it handles it, nevertheless, very effectively, as we've seen. But it is a constant word-processing approach. The feedback and help features, I think we've seen, are quite sophisticated or can be quite sophisticated; although they are sometimes rather limited.

What kind of a role in a curriculum can you expect from those kinds of materials? Wolfram conceives his system as solely drill-and-practice. Graham Davis conceives his system as solely drill-and-practice. The USC system is used to replace homework, drill, and practice assignments. Basically this is what computer-assisted language instruction using a template seems to be moving towards. I should like to move on to a brief of free-form systems.

I will use as an example our own CLEF project, which we worked on with teams at the University of Guelph and the University of Calgary over the last four years. It's just coming close to the end, mainly because of funding, but also because we're reasonably close to the end of the actual project. We had a lot of money. We were funded by the Ministry of Colleges and Universities. What did we do? Firstly, the presentation of information. What did we do in our lessons? We used color microcomputers built by Intelligent Systems Corporation. You've probably never heard of them. That's fine. Most people haven't. But they were the state-of-the-art four years ago. They're Compucolors and Intecolors, color micros. We discovered that to present information the micro is a phenomenal medium; it can present information in ways which no other medium can match, and I would even put interactive video there. With the use of color, movement is a phenomenal weapon. Color is too, which you can use to emphasize all kinds of things. With screen management you can manipulate the screen, certain parts independently.

SLIDE 1 In one lesson we teach the position of French adjectives. (I'm sorry there is no way this can duplicate what happens on the screen; you've got to use your imagination.) We start with a *blanc* on the right-hand side of the screen. Why right? Because we want to show it goes to the right of the noun, which we blink to show that's the noun. So *blanc* moves to the right of the noun. But of course that's after the period is moved to the right to allow space. Now you can imagine what we can do with an adjective coming from the left, or two at a time: one from the left and one from the right. You're simulating a syntactic process dynamically.

SLIDE 2 Tenses. Again you have to use your imagination. This is the famous time-line. So you start with *je chante*; *je chante* can move one character at a time back through *that barrier which* is the time frame into the past. And as it does, it emerges as *j'ai chanté*; then it comes back to *je chante*, and goes to the future (which is the *futur proche*) to *je vais chanter*. Now, on this slide, these prototypes for Frankenstein's monster here are in actual fact just a poor simulation of what happens on the screen, and there's really only one head. There aren't three. But we start with a head that says *je vais chanter*. Then dynamically moving notes come out of the mouth to indicate *je chante*. When they stop, we state *j'ai chanté*. Now that, I believe, is a reasonably effective way of showing the difference in tenses.

SLIDE 3 This is Frankenstein's monster in bed. We start here with *Paul dormait profondément*. Then we have the alarm clock jump up and down--sorry we don't have any sound coming out. And then we add *quand le réveil a sonné*. Now what we are trying to demonstrate is that an imperfect can be used to indicate a state, and the *passé composé* in French is when something suddenly happens.

In terms of the analysis of student input, we programmed every lesson independently. It took us probably more time to do the error analysis than any other part of the whole lesson. We did it on the basis of a grammatical analysis, according to each grammatical point that we were dealing with, and the specific exercise in that grammatical point that we were dealing with. This took us a lot of time, particularly to do things for a multi-word input where we were bothering about hyphens, apostrophes, and what have you.

So what am I trying to get at about free-form systems? I am trying to show you that an awful lot is possible with free-form systems that you cannot do in a template system. But are free-form systems the best way to create lessons? Well, for us, no, for the simple reason that we decided that we cannot do any more courseware unless someone wants to give us $100,000 and another three years time.

So, it's not feasible. It just takes too long to do it this way. So what have we done? We're now changing our thinking. We've gone onto Commodore PET and what we are trying to is standardize those parts of a CAI lesson that can, without sacrificing quality, be standardized, and thereby, we are creating a series of templates, so to speak, for certain parts of the CAI lesson. The University of Illinois at Champaign-Urbana is doing the same thing. The University of Southern California is now doing exactly the same thing. They are standardizing via templates what can be standardized without sacrificing quality; what they are keeping is original programming for certain parts of a CAI lesson which would not be done, or would not be done effectively, if they were standardized via a template approach. This combination of free-form and template systems is the hybrid approach which, I believe, can lead to the relatively rapid creation of quality CAI courseware.

SECOND KEYNOTE ADDRESS

COMPUTER-MANAGED INSTRUCTION: PRO AND CON

DR. DAVID M. WEIBLE
DIRECTOR, AUDIO INFORMATION SERVICES
University of Illinois at Chicago

There is a whole alphabet soup of abbreviations associated with the use of computers in the areas of education and training. Of these, CMI, CAI, and CBE are perhaps the most interesting categories for describing the varying ways in which computers may be used in the educational or training process, i.e., as the manager of the instructional program, as an instructional assistant, or as the primary (perhaps even exclusive) source of instructional input. Used this way, computer-managed instruction has generally been understood to mean that the computer's primary function as an aid to learning is as a record keeper, particularly with reference to modular, individualized study programs. In this capacity, the computer can greatly assist the instructor by handling the detailed record keeping needed to track each student's progress through numerous study modules, pre-tests, mastery tests, post-tests, reviews, et cetera. But that function is only one very limited aspect of my topic for today. Let us look at the broader subject of the computer as manager of the instructional process.

Central to this broader view of the computer's function is the concept that it should not merely keep records on each user, reporting upon demand to the teacher, and serving essentially as an electronic grade book, but that it should also be programmed to interpret these records and adjust the presentation of subsequent instructional modules on the basis of that interpretation. These adjustments would serve to accelerate the learner's progress through the material by concentrating on those aspects which give the most trouble while de-emphasizing or even eliminating others which are observed to cause the learner little or no difficulty. To achieve this it would be necessary to implement a rather elaborate system of diagnostic feedback which would serve as a basis for the generation of a profile of each student's strengths and weaknesses. Such an approach requires, of course, that the computer be "in charge," telling the student, or at need even forcing the student, to study this or that unit.

Clearly there is a danger in such an approach, chiefly that the students will very much resent being bossed around, particularly those students who are using the courseware only because they are required to do so--often the very same students who otherwise stand to benefit most from this kind of work. In the worst instance, we may imagine students with low linguistic aptitude who are taking a foreign language only to fulfill a requirement, who wish to do as little as possible to get by in the course, and then find themselves saddled not just with an additional set of assignments outside of class time, but assignments administered and supervised by a bossy machine which actually forces them to review items they thought they had finally done with (after much hardship and suffering). This does not sound promising as a way to win the hearts and minds of such students. And yet it is this very group of students who most need help, and particularly the sort of help which thoughtfully-designed courseware could provide. Of these, some can be won over to some extent by programming which entertains as well as instructs. Professor Marty of the University of Illinois at Urbana, a man of long and broad experience in foreign language work on the PLATO system, argues, however, quite strongly against both requirements and entertaining courseware.

In his article "Reflections on the Use of Computers in Second-Language Acquisition," published in *Studies in Language Learning* (1981), 3, Marty presents good, sound arguments for the direct involvement of FL teachers in CAI development work. However, despite his own enthusiasm for CAI, he is strongly opposed to any requirement of such work.

> "Computerized instruction will surely fail if it becomes another weapon in the teacher's arsenal, if we assume that the teacher/student relationship must be of an adversary nature and that our role is to use all available means to teach the students in spite of themselves."

On courseware as "entertainment" he states,

> "...there is no need to reward him with special effects (animation, a personal message, a joke, etc.); for the student who wants to learn, this is a waste of time. By using such superficial rewards, we continue to assume that it is natural for a student not to want to learn and that our main task is to coax the student, manipulate him and, in a way, trick him into learning without his realizing it."

While he cites no concrete data to support these beliefs, it would be foolish of us to assume that he is simply voicing a personal prejudice (though, in fact, a kind of academic prejudice may indeed be involved along with other factors in the shaping of his opinions). He bases his opinions on years of first-hand observation of student interaction with CAI materials, both his own and that of others. His fear that the computer might become a tyrannic, manipulative, and dehumanizing "Big Brother," blighting academia by perverting its essence, is one which we dismiss from conversation only at our own peril. The force-feeding of students with subject matter content is not consonant with the traditional and widely cherished view of the university as a locus of independent academic inquiry and discourse. One must energetically combat any tendency for education to evolve into the "processing" of students. Data processing today--student processing tomorrow! It is certainly a possibility.

But even granting the validity of Marty's concerns, the conclusions he draws regarding the efficacy of CAI tend to argue against his own position of strict noninterference by both software and instructor in the manner in which the students choose to interact with the instructional programs. He sees CAI providing a gain in time and performance for some students, but only if:

- -- the computerized materials offer the large arrays of cues, feedback, and error analysis I have described;
- -- and the student utilizes intelligently all those resources and options: making the right decision as to what is the best step to take when he makes an error (look at the syntax cues, use the error analysis, review specific grammar items, etc.) and using efficiently all the performance data with which he is supplied.

If these conditions are met, he feels confident that "computerized instruction can substantially help us prepare the language experts we need." This strikes me as being a remarkably inconsistent conclusion for him to have drawn. Indeed, the only hope I see for reconciling it with his earlier injunctions is to assume that his basic argument is elitist in nature. With that, let me add that I am not anti-elitist. There is something to be said for the view that one should take into account the striking capability for a certain sort of superior performance possessed by some people. Some of these people will doubtless be intrigued by the thought of working with computers in foreign language study and choose to do so voluntarily. Some of them might in fact be put off by possibly clumsy attempts at humor and entertainment grafted onto the "meat" of the program. And it is not unlikely that a fair percentage of these bright users will also succeed in using the computer "appropriately"--all of which will very likely result in them learning the material better and faster. And there's absolutely nothing wrong with that; in fact, I think it's good to see some attention paid to improving the quality of instruction dished out to our "gifted" students. Given some help, they doubtless can make even better use of their potential, and that is indeed a good thing. But what about the other 95 percent?, or is it only 90 percent? 85 percent? You can be sure it is a substantial majority, at any rate. Surely they need assistance even more than do the top students, and where they need it most is in the area of learning strategies and study skills.

There is at present no better medium for teaching the special study approaches and skills needed for successful foreign language study than the computer, precisely because of its ability to manage and structure user interaction with the material. For many students, particularly those with low linguistic aptitude, the greatest benefit they may derive from working with an appropriately designed computer program will be improved learning skills. Earlier I referred to the "worst instance," in which we had to deal with students with low linguistic aptitude, taking a foreign language only to fulfill a requirement, and wishing to do as little as possible to get by in the course, and then finding themselves given an additional set of required assignments outside of class time, administered and supervised by a bossy machine which forces them to review, not at their convenience, items which they would really rather not think about anymore. I observed at the time that it seemed an unlikely way to generate much enthusiasm. In point of fact, I am able to describe what can take place under these conditions rather more precisely than that, having personally authored and supervised just such a program at the University of Illinois at Chicago. At that time, we administered parts of the Modern Language Aptitude Test to all beginning students of German and placed them into an "accelerated" or a "normal" track depending upon their scores. They had no say in the matter. After the first quarter of study, outstanding students in the "normal" track and weak performers in the "accelerated" track were given the option of switching, but in the event there was very little of this. The "normal" track students, roughly 70 percent of the overall enrollment, followed a modular form of study, with Lederer's *Basic German* providing grammar essentials, readings in the Goedsche-Slaettli series for classroom use, the "Guten Tag" films and textbook serving for audio-lingual work, and 36 reading and vocabulary exercises and an irregular-verb drill program on the PLATO system rounding out the program. There were also a small number of CAI grammar modules available for use but not required. The Lederer, Goedsche-Glaettli, and "Guten Tag" modules were all covered basically in the four weekly class meetings. The PLATO materials, on the other hand, while required, were to be done on the student's own time. The only direct classroom reinforcement of this work was in the form of brief quizzes given three times each quarter and consisting of "reconsituted" reading passages with discreet and global comprehension questions.

The only truly unique elements in this program were the PLATO materials. The earliest unit had been developed under a curriculum development grant from the university in the early 70's. As these have been described in some detail elsewhere, I will only give a very brief outline of them here. The underlying principle is literally an ancient one, having been used in antiquity for teaching Greek to young Romans. One simply takes a native language text, preferably one whose contents are quite familiar, and makes selective substitutions in the text using target language equivalents. The student is then encouraged to take his knowledge of the familiar context and use it to infer, or as some prefer to say in this setting, inference the meaning of the interspersed target language items. The advantage such an approach has over "flashcarding" lies in its potential for forcing the student really to think about the context and any other clues as to the word's meaning. In terms of our present discussion, this means that the student while learning specific subject matter content was also learning a learning strategy, that is, that the meaning of a word is more or less dependent upon the context in which it occurs. As most of you no doubt have observed, this knowledge is not at all intuitive in second-language learners. They seem instead to regard foreign languages as encoded versions of their own native language and generally seek to decode them through the use of "paired-associate learning." As we all know, this strategy simply will not work--otherwise it would not prove so difficult to have effective computer-based translation programs--but it is dreadfully difficult to convince our students that such attempts are wrong-headed. This CAI program quite simply forced them to take notice of the role of context in determining the meaning of individual words; rubbed their noses in it, one might say. For example, in the first three drills, the word als was used with three very different English meanings ("when," "than," and "as a"). In other ways too, the program sought to teach not only vocabulary, but useful reading skills.

Initially there were only 16 such passages on the computer, enough really only for the first quarter of study and definitely not enough to determine whether the students were benefiting from their work with the computer to any significant extent. The earliest research results generated by student interaction with this first lot of drills were, however, sufficiently interesting to interest Exxon in providing sufficient funding for a 12-month leave of absence for me and support in the form of a half-time programming assistant. At the end of the grant period, enough drills had been generated to serve as accompaniment to an entire year of study. In addition, a moderately flexible irregular-verb drill had been written which interacted directly with the vocabulary and reading passages, in that it singled out for study those verbs which the student had already encountered in the reading drills and with which he had had difficulties. Also, the new reading drills were methodologically superior to those developed earlier, in that they allowed for systematic analysis of the type of errors the students were making. I am running short of time, so I won't go into all the details regarding just how the evaluation of this material turned out. The most important point certainly was the notable improvement in the performance by low aptitude students. All of these students had been given the MLAT before beginning their coursework, and, until the introduction of the PLATO materials, the MLAT scores were highly predictive of the student's final grade at the end of the first year. Low aptitude, low grade. It worked out pretty neatly. It was enough to make you wonder if we should really bother teaching them, when the MLAT was so beautifully predictive of what they would achieve.

And what happened when they were forced to go through these PLATO materials? It shook up the correlation nicely. In fact, it caused a distinct decrease in the correlation to the point where you found people with low linguistic aptitude at the beginning of the year who ended up performing globally as well as "high aptitude" students. This result suggests that they had learned more than additional subject matter content; it suggests that they "learned aptitude" for language acquisition. My time won't permit me to expand on this too much, but I hope you will give some serious thought to the thesis that it is possibly more important for us to use computers to impart learning skills and strategies than it is to simply cram information into our students. I'm not saying that what I did on PLATO was terribly wonderful; the materials weren't as good as they might have been. They could have been more effective. And certainly, they weren't universally beloved, although I did attitudinal testing on them. On a scale of 0-7, they usually came out 5.5 which isn't disgusting. All the same, forcing the students through the material like that, well we don't really know well enough what we're doing. I don't think we have a terribly clear notion of how second languages are acquired. But the only way one can develop CAI materials is to base them on what one knows and on what one thinks one knows about how a second language is learned. Now what I would like to argue is that while I think Marty's concerns are not at all to be ignored, we should not entirely renounce this tempting opportunity to acquire more definite knowledge as to how language is learned. I once was speaking with a member of my department about the whole concept of instructional methodology and was met with the statement, "Well, it's certainly not a science!" I could only reply, "Well, if it's not a science, it ought to be one." I think it is essential that we get more hard data on the various aspects of second language acquisition. Surely there is something going on there which can be measured, evaluated, and checked out. At the same time, we know that whatever data we manage to gather initially can be used to build on, and perhaps we will eventually get to a point where we can really produce materials which are truly effective, which may even have surprising results. I'm being rather futuristic. I'm sorry, but I'm a keynote speaker you know; we do that sort of thing.

Most importantly, I do want to emphasize that we mustn't ignore the computer's chief advantage over all other instructional media: its ability to be flexible. This is where I think we will find our solution to the question of whether or not to require the use of CAI materials. It is perfectly possible to create program materials which leave options open. I can imagine a situation where the instructor first of all could get into the program and be given a range of choices as to what latitude the students are to be given in dealing with the courseware. Choice A might be to leave all instructional management up to the program itself. Under choice B, the instructor could set the parameters for work with the material; and under choice C, the student could be given total control over how much he chooses to do and how. Why not have it that way? With such a flexible approach, we could at least choose whether we want to have our cake or eat it. Computers can structure the student's learning experience, possibly greatly to his advantage, and it would be folly to overlook this power. But there is nothing wrong in allowing the instructor or the student to decide on his own whether or not he wants to take advantage of it. As we look to the future of this field, we should still be thinking as to how we might ever expand our options, not limit them.

HOW TEACHER-INDEPENDENT CAN CAI COURSEWARE BE?

FRANCIS OTTO

Brigham Young University

There has been considerable interest expressed recently in designing and implementing exemplary programs to teach native as well as foreign/second languages with the assistance of a computer.

As we study the feasibility of such projects, we must determine objectively what ways and to what extent Computer-Assisted Instruction (henceforth referred to as CAI) can make a unique and significant contribution to teaching languages more effectively by providing teachers and students options that would not otherwise be available.

It has been my pleasure to direct CAI materials-development projects for the past seven years: seven years with a grammar review course for students of EFL/ESL that is delivered on the TICCIT system at Brigham Young University; four years with two courses for speakers of Spanish utilizing the PLATO system at numerous learning centers sponsored by the Control Data Corporation, under whose grants the projects were completed; and two years with a grammar review course for students of EFL/ESL who use the Apple system at Brigham Young University and elsewhere.

In the course of this research, several conclusions have been reached concerning ways in which language teachers can remain in the forefront as CAI curricula are designed, implemented, and evaluated. On the basis of over 10 years of experience with research, development, and instruction dealing with trends, issues, and capabilities of CAI systems, we have learned two very basic lessons of considerable importance: first, a competent teacher must manage a teaching-learning process, and second, the letters CAI stand for Computer-Assisted Instruction; that is, the purpose of the computer is to assist the teacher, not to replace the teacher (CDC's initial request).

The major trend in teaching and learning during the past decade has been toward individualized instruction. This quest has not only altered the basic classroom situation, but the roles of teachers, students, and administrators as well.

CAI is the latest in a long list of acronyms associated with individualized instruction:

IEP = Individualized Education Program

PI = Programmed Instruction

MI = Modular Instruction

PSI = Personalized System of Instruction

IPI = Individually Prescribed Instruction
IL = Individualized Learning
PI = Personalized Instruction
IGE = Individually Guided Education

Regardless of the system used to individualize instruction, the following components are common to all:

Program Input	Program Output
Foreign Language Curriculum	Student Competence
Teachers	Student Motivation
Pupils	Teacher and Student Satisfaction

In order for an exemplary foreign language curriculum to be established, enabling and terminal teaching and learning objectives must be clearly defined. These tasks must be accomplished by the teachers and administrators involved. Only they know the needs and preferences of their students on a first-hand basis. Only they are in a position to state educational specifications in such a way that hardware specialists can design systems capabilities that are in keeping with the stated goals of the program. Teachers and administrators who are dissatisfied with CAI programs seldom have played a role in providing educational specifications. Too often, they accept the suggestions of hardware specialists who provide courseware more by default than by special design. Such courseware rarely meets the needs of administrators, teachers, and students.

Teachers and administrators must also state acceptable levels of student mastery. Student competence in CAI programs is usually measured on the basis of the mastery model; that is, students must perform at an acceptable level of mastery before they are permitted to progress to new lesson material. We have used the 80 percent level of mastery in all of our projects to date. While the figure is purely arbitrary, it seems to be very realistic.

The computer is an information-processing device, capable of storing large amounts of data for delivery in alternative approaches to learning that enable each student to use the computer as his/her private tutorial learning facility. The computer cannot be excelled as an information-processing machine. The computer is to information processing what printing is to information transmission; however, the quality of the CAI program is only as good as the courseware design provided by the people who will be using the material daily. Teacher input is absolutely indispensable and is the single most important component contributing to quality control. Without teacher and administrator input in providing needs assessment and task analyses, the CAI program is doomed to constant revision and/or failure. In addition to teacher input as just described, teachers must support the CAI program from the very beginning. CAI requires concentrated attention from each student, who is given a reasonable amount of time to formulate responses to questions relating to concepts, rules, communication patterns, and test items. CAI provides tutorials in the form of helpful hints and advice that are programmed wherever errors are anticipated. The computer records student errors, maintains progress logs, and encourages students to correct errors before they become habituated.

The feedback system in CAI is one of the most important keys to the successful development of language proficiency. Therefore, one of the major tasks of teachers working with CAI courseware is that of processing student feedback. Immediate feedback is valuable to teachers and students if it deals specifically with definable communication skills and if alternative remedial steps or branches are programmed to prevent the recurrence of similar errors in the future. Feedback, whether positive or negative, must provide encouragement while relieving feelings of tension that are often found among foreign language students involved in the process of acculturation. There is simply no substitute for a qualified and caring teacher, one who obtains feedback, diagnoses need, selects options available, and follows up so that the student experiences closure in solving problems encountered.

Critical considerations must be made by the teachers of every CAI program. Design, development, and programming of CAI curricula cannot be successful without carefully considering goals in terms of enabling and terminal teacher- and student-performance objectives. Lesson and unit contents must include detailed specifications of the interaction between language and culture, and the impact on the organization of lesson content. How the content is delivered on on-line or off-line lesson components depends on how material is sequenced and upon the methodologies employed. Language assessment must be charted from the beginning of courseware development so that information gaps are avoided, adequate and timely review is provided, and care is taken to avoid cognitive overload. Without the close cooperation of teachers and administrators, these objectives are not attainable.

The concern that CAI may have a dehumanizing influence is quickly dispelled by students and teachers who discover that CAI offers a freedom of choice over a wide range of activities while charting areas of weakness and levels of mastery.

Although the primary aim of CAI is to make learning easier and more palatable, it can also make teaching much more challenging and rewarding. Alternative student paths make it possible for students to have multiple exposure in areas where mastery is problematic. The central purpose of CAI is to expedite certain aspects of the teaching-learning process: presentation, reinforcement, application, and testing.

Personally, I believe that the interactive videodisc approach offers the ultimate solution to the inadequacies of CAI in the areas of listening, pronunciation and speaking. The videodisc provides a more realistic and totally communicative sound dimension that is especially appealing to language educators. There is no other CAI system available at this time which remotely approximates the sound capabilities of the videodisc. Also, the color and definition of the graphics available via videodisc make this delivery system highly appealing.

Although CAI is still in its early stages of development and sophistication, it offers language teachers and students another tool that enables them to realize objectives in both the cognitive and affective domains. CAI successfully combines technological capabilities with pedagogical principles so that these two areas are mutually supportive. When correctly used, CAI maintains high levels of student interest and motivation while offering unique opportunities for teachers, students, and materials developers to interact in ways that would not be available in other modes of instruction.

The educational promise of CAI includes the goals of individualizing and personalizing instruction, simulating experiences not otherwise available, enabling students to work at their own pace, and gearing instruction to what is commonly referred to as the mastery model.

Just when planning the instructional specifications, teachers must choose objectives and design courseware that require student interaction to the fullest extent. Content and evaluation must be totally objective and there must be provision for alternative student paths.

The much discussed technology-pedagogy gap exists, but is decreasing rapidly. Technological capabilities far outweigh the quantity and quality of CAI courseware designed to deliver instruction in the areas of grammar, reading, and writing. The current state of the art in videodisc technology promises opportunities to deal satisfactorily with listening skills and offers challenges to improve response judging in the two critical areas of pronunciation and speaking.

CAI is most useful when feedback is necessary. Data collection is most important; in fact, the record-keeping function provided by well-designed CAI courseware gives teachers and learners opportunities to achieve levels of on-going evaluation that would be inconceivable with conventional instructional programs.

At a time when CAI capabilities are advancing in quantum leaps, teachers must help in order to address the following critically important research concerns:

1. Are students able to learn more in less time with the proper use of CAI?
2. Will student levels of performance be higher due to the tutorial nature of CAI?
3. Will CAI yield higher levels of retention because of the highly personalized nature of the instructional program?

4. Will CAI result in higher levels of teacher and student satisfaction because of the availability of alternative teaching and learning activities?

5. Will the use of innovative CAI design principles significantly reduce the cost of interactive instruction?

6. Will long-range implementation and maintenance costs for courseware be reduced through computer applications?

Whatever our future may be in CAI, the extent to which we will be successful depends more on teacher participation than upon any other single variable. I hope that you will accept the challenge to become involved in a way that is meaningful to you. While CAI is self-contained in terms of its packaging, it is not teacher-independent in its approach to instruction.

IMPROVED APPROACHES FOR DESIGNING FOREIGN LANGUAGE INSTRUCTION

MICHAEL DEBLOOIS

Utah State University

Introduction

My presentation today is entitled "Interactive Videodisc: Improved Approaches for Designing Foreign Language Instruction." Inasmuch as I am not a foreign language instructor, I am focusing on the word "designing" rather than "foreign language instruction." I don't know much about teaching foreign languages, but I believe I know a little bit about improved approaches to designing any type of instruction, and that's how I intend to focus today. I will save some time at the conclusion of my presentation to show a small portion of an interactive videodisc that we have been working on this past week. Later on in the afternoon I have been asked to direct a workshop related to the design of this German language disc, and those of you who have interest are welcome to attend and deal with it in some depth.

Technology: A Changing Concept

A number of years ago I was listening to the "CBS Radio Theater of the Air," and in this particular radio play, the metals of the world (iron, steel, aluminum) conspired to rebel against their "masters." Bridges collapsed, cars fell into pieces, computers stopped working; the world was in a hell of a state. People couldn't get home from work, their watches wouldn't run. You know, everything went awry and it looked as though the earth was finished and done for. Finally, as the play concluded, the metals were whipped back into shape, their structural integrity returned, and the problem was solved. I use this radio drama to lead up to the first point of my presentation today. My title suggests that I believe we need to change some of our behavior when it comes to designing instruction. Basically, I'd like to point out that we need to use better concepts when it comes to designing, and that we should use better tools for implementing these concepts. My metal story gets me into the first point. I think we need to change our concept about technology. Attendance at this conference and every other conference that I have been to recently tells me that we have an inappropriate concept related to technology. Technology is more than metals, machines, equipment, gears, motors, and electronics. When someone speaks of "technology" we all think "machines." I believe there is a hard and soft side of technology. The hard side definitely turns out to be a machine of some sort. The soft side is that hidden portion that went into putting the concept together that results in the machine. The planning, the thinking, the paradigm, the flow chart, all of the thinking that was conceptualized and put on paper in a systematic way to allow that hard side of technology to emerge represents this soft technology. Frankly, I am less impressed with the hard side of technology than I am with the soft side. I see a lot of gimmickry. I see a lot of faddism. I see a lot of planned obsolescence. I see a lot of changing--I can scarcely keep up with it--and when I talk to people about technology, they expect me to be up-to-date on the current model of the latest player. I can't keep track of it all; I don't know where it's going.

The soft side of technology, on the other hand, is a bit more stable. It tends to be developing and maturing more gradually; people are adding bits and pieces as time passes, and are putting something together that I think is becoming rather substantial.

The Power of Interactive Tools

Let me quote from a paper that I read recently. This is written by Michael Strebel (1982) of Pennsylvania State University. He has a statement about technology which relates to the videodisc that has been mentioned so much in our presentations of yesterday and today. "The real power of intelligent videodisc lies in its ability to act as a completely adaptive instructional tool." The key words here are "power," "interactive," and "tool." "Power" is a result of the fact that all of the video and audio information can be randomly accessed by a microcomputer which in turn is driven by the diagnostic and prescriptive procedures built into the computer program. The task facing the designer of such a system is therefore truly monumental. How can all of these variables be kept under control so that the final product achieves its intended purpose in a harmonious and user-friendly manner?

The soft side of technology is that controlling mechanism which allows us to keep all these variables under control so that they can be applied to the intended purpose. The question of improvement in language training is not so much whether teachers can somehow bring themselves around to use machines; the question is whether they can master this soft technology process of planning and controlling so that the results of their work end up in some kind of synergistic effort. So frequently we face the dilemma of having humanist/technologist "straw men" set up for us. We are torn, deciding whether we are going to be all of those things that represent the humanist--which are all good--or whether we're going to somehow become the technologist; and I think it is a phony issue. The real question is, "Can humanistic instructors use appropriate concepts and tools which allow them to control the variables so that they can deliver instruction in an effective way?" Equipment frequently allows this to happen.

Another quote from Strebel shows where I am going with this. He begins, "The instructional systems design process gives a designer team member a number of practical benefits. First, it helps them to understand and control the whole process. Each step is articulated and related to previous and subsequent stages, and misunderstandings among team members are avoided. Clear communication is an absolute essential component of effective team work. Second the instructional system design process helps the design team to complete a project with a minimum of energy." That translates into time as well as money. Potential problems are worked out before they are developed into hardware and software systems. Finally, "The ISD approach helps maintain a systems level harmony in the design process as well as in the operation of the final product." That is, all stages work harmoniously toward a common goal in the design process, and all the parts of the final product display conceptual unity. Well, I wish it were that way all of the time. Of course, it's an idealistic statement. Nevertheless, the contention is that we should focus more on the soft side of technology, controlling the variables, trying to create the synergistic output, and maybe focus a little bit less on the hardware vehicle that carries the product of our design work. That's the first concept I'd like to change. I would hope that language teachers would start focusing on the soft side rather than the hard side of technology.

Improved Instructional Design

Many of you that have taken basic design courses would recognize that FIGURE 1 is a model for the design of instruction. This particular model was developed by Lester Briggs, at Florida State University. I don't recommend that language instruction necessarily follow this particular model. I do, however, recommend that you use a design model of one sort or another, and that you have an algorithm which describes how you are going to go about designing your language instruction, to help you identify what all the variables are--and how they relate to each other. A model which establishes some kind of sequential approach to putting ideas together and that builds into the process an element of control. Now, I don't know that this use of a model is necessarily anti-humanistic, and frankly, I expect it would help people who view themselves to be humanists to really deliver that humanistic talent.

FIGURE 2 is enough to frighten anyone. What self-respecting language teacher would ever stoop so low as to actually perform a task analysis and relate all of the parts of the problem in such a way that they can really comprehend the holistic job that they are trying to accomplish? FIGURE 2 is a simple hierarchy of skills that has to be accomplished for someone to use a multimeter.

It occurs to me that if I am going to successfully interact with someone in a foreign language, there must be some kind of similar structure that would need to be taught; frankly, I think that this business of using soft technologies to help us identify that structure would be useful in language instruction.

If you don't like flow charts, if they are too foreign to you, maybe a simple list, such as shown in FIGURE 3, will suit you better. A list of processes that would have to be carried out in some sort of orderly way then is the type of technology that you should employ to design more effective instruction.

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Design Assumptions

Now allow me to move onto the next concept I think we've got to improve upon. We make certain assumptions about designing materials, and I think we have to reexamine many of these. Many of these assumptions are no longer valid. Here are some current assumptions that people hold who design language instruction.

Linearity

First of all, they assume that all delivery capability is linear. We read newspapers linearly, we read books linearly, we speak linearly; a movie is viewed linearly. We live in a linear world. This is the assumption that designers enter the design process with; unfortunately it is no longer valid. With the power of the computer hooked up to videodisc players, we can break out of the linear mold. The assumption is no longer valid. Why does it persist?

Homogeneity

We assume that learners form a homogeneous audience. For 20 years now, we've been told that learners are not homogeneous, yet we persist in assuming that they are when we design instructional materials. It is not because we are stupid, it's because that up to this point in time we could only address the homogeneous assumption. Because of cost or effort, we have developed one lesson that was delivered to all people. I think that this issue needs to be reexamined.

Sequential Development

Sequential development is a lot like linear development. For some reason our mind moves sequentially. The computer is not necessarily a sequential tool. It does not care whether one goes from one to two, to three, to four. It would just as soon do it backwards, or from the middle out, or from the outside in. We impose that kind of assumption on our thought processes. This too needs reexamination.

Dominant Media

The dominant media assumption goes this same way. Show me a CAI person, and his or her lessons shall be and will be forevermore CAI. I'm a slide-tape specialist. My lessons will use slides and audio tape...and they always have. We allow a particular medium to take over, and we can't think creatively and move from one medium to another and do it rapidly. You see that I am shadowing the videodisc which has a lot of different media imbedded in it, and we no longer need be held hostage by dominant media thinking.

Validation Limitations

Limited validation cycles: if we are fortunate enough to perform one validation, we write our report, heave a great sigh of relief--we have validated our product--and go on to bigger and better things. One-time validation. All of a sudden, we have the opportunity to revalidate instructional materials each and every time they are used. And in creative computer projects this is currently being done. But the assumption still lingers in favor of one-time validation to determine lesson effectiveness.

Resource and Lesson Materials Separate

This is an interesting problem to me. With 108,000 frames on a videodisc, and 20 megabytes of computer storage on a hard disk, why do I continue to separate instructional materials from their related resource materials? Good gracious!!! I can put the entire holdings of our meager library in my lesson if I choose to. Why not change this assumption that the student studies the lesson materials, and then if he or she needs more information, he or she trots along down to the library...which they never do. Why not bring the library to the student and include relevant resource materials with the instructional materials?

Materials Dissemination

We are into this tradition of having one set of materials for each student available at the institution between the hours of 8:00 a.m. and 4:00 p.m. This limitation exists because materials cost a lot of money. However, we are starting to see a glimmer of hope that materials will be created which are very personal, and because of decreasing costs, students will be assigned private copies to take home or use wherever and whenever they please. Many of you who are using floppy disks for instruction actually give the student the disk and they can take it wherever they go, stick it into an Apple or other micro, and do their lessons. That is the nature of the thing I am talking about.

You can now see where I am headed. I think that we need to get rid of these assumptions and adopt those shown in FIGURE 4.

Mosaic

We should begin looking at the development of instructional materials from what I call a mosiac multidimensional point of view. Rather than thinking linearly, let's place ourselves in the middle of a three-dimensional matrix, being capable of expanding to any cell in any sequence, at any time, as in FIGURE 5. The number of instructional possibilities are infinite when you put yourself into that kind of assumption. Each student, indeed, could have a lesson that is unlike any other lesson taken by any other student. Now you know, in practice we don't presently do that, but it's possible to create lessons which respond to a lot of variance. The rapid random accessibility of the computer and videodisc makes this idea feasible. We can start actually thinking about heterogeneous audiences and develop instruction based on that assumption. If we begin to develop our materials in modular clusters, then it is possible to move from one main cluster to another and develop learning maps, each really quite different from the other. Although at the theoretical level a different lesson can be created for any student, practically we should at least begin to develop instructional materials which individualize for several levels of instruction.

On a recently developed interactive videodisc set of lessons, we created 352 of these clusters. Then as the students went through the lesson, we would diagnose how they were behaving and "insert" them into any one of the 352 clusters, each in a different order, as each particular case required. And you know, even though we were not very good at it, and didn't know much about it, it was successful. Our population of 352 instructional clusters was very useful for individualizing instruction in that particular set of lessons.

Interactive Videodisc Advantages

FIGURE 6 shows the main instructional advantages of interactive videodisc instruction. I don't need to go over it in great detail. The point is that all of a sudden, when you combine a computer and a videodisc, you come up with delivery capabilities that we didn't dream about five or six years ago. The capabilities that I think are most impressive are those that relate to random access of great amounts of information which are available in audio, visual, and fast motion, full color, and stereophonic sound. Five years ago I had no idea that I would be able to develop instruction and deliver it on a vehicle that powerful, and all of a sudden I have it.

I won't spend a lot of time discussing the disadvantages of this vehicle, but there are a number. My purpose is to emphasize that designers of instructional materials should not limit themselves by the assumptions they carry about the delivery vehicles available to them. If we overcome a few of these limitations, suddenly we will begin designing better lessons because we'll know that there are vehicles available with capabilities that more than match our ingenuity.

We should develop better concepts about lesson formats. Let's assume that the matrix in FIGURE 6 represents the 352 instructional segments I referred to earlier. Learner A comes along and receives a particular configuration of components, perhaps because learner A is a slow reader, or maybe because learner A prefers to learn through the ear rather than through the eye. Or perhaps learner A wishes to be presented with the whole picture before he or she sees pieces of it. Now on the other hand, Learner B might prefer to work from the simple to the complex, or is an excellent reader and would rather read technical information than have it presented in an audio mode. You can see that each additional learner who comes along can reconfigure the format of the lesson based on his or her particular learning style, prerequisite skills, or perhaps just on a whim. I believe that if we change our assumptions and develop stronger concepts in these areas, our work will be automatically less inhibited, more imaginative, and the lesson planning more creative.

Design Tools

Now allow me to move from concepts to tools. Marion Bender, who is a former graduate student of mine, did a thesis on the use of videodisc/microcomputers in foreign language instruction. Bender has something to say about developing better concepts, about available tools. I will paraphrase her report. "Based on research reports in foreign language instruction, foreign language instructors are not using what they already know to be true about quality instruction. In almost every case where language instructors use visuals, sound with motion video, or where they have students interact with real native speakers, or with native speakers on videodisc or some other representation of visual and audio, students perform better in acquiring language skills." Bender cites source after source which identifies tools that language instructors have proven to be effective in promoting language acquisition. But we have all been slow in adopting these tools as we plan our instruction.

Many of the presenters in this conference have talked about "authoring tools." My grandfather was a ship's carpenter in the Netherlands. He had a love affair with his tools, many of which eventually were passed on to me. They are over a hundred years old; they have the soft patina of the oil from his hands, and the steel is unblemished and well-oiled. They are things to behold. He knew how to use tools. They were kept handy and cared for. They were constantly used and played a major role in what he did. Now, how do we as instructional designers relate to the tools of our trade? First of all, we don't use very many, and those that we do use are kept in the closet, out of sight and mind. I would argue that we ought to have tools that are constantly at our fingertips, well-kept, available, used much as those in grandfather's analogy. In the past, my tools have been paper and pencil, because the development of electronic authoring tools is lagging. It's coming along much slower than what I had hoped. Eventually, the computer will be used as an authoring system, and will give an instructional designer ready access to a whole tool chest of increased opportunity. FIGURES 7 and 8 show a few of the tools that I currently use in the design of interactive videodisc instruction.

This is not an elaborate tool. It's really nothing as grand as those my grandfather used, but you'll notice that it guides me in a way of thinking about lesson design. I've got an element here that identifies the topic, the goal, and subsequent objectives of instruction. I have a box that causes me to analyze my audience and come up with some quality thinking about how I am going to design the learning cues from those audiences. In the center of the figures, you'll notice that I have spaces for three audiences. When I design materials, I can't think only about the average student; I am forced to design for at least three levels of instruction. I am working on different kinds of learning conditions and teaching conditions, and I develop instructional cues to support each one of those three levels. The planning sheet in FIGURE 7 is really only a two-bit tool; it is not very elaborate nor powerful, but it is a tool which helps me to do the job which otherwise I am too lazy to do if I didn't have the device.

Here is another tool that I have developed. My early videodiscs were not much more than slide-tape presentations transferred to videodisc. The disc was driven by the audio, and I used images in support of the audio message. Because the videodisc is a very sparse audio source, my discs contained limited amounts of material. Thirty minutes of audio and I was done, without getting much past the introduction. So this second tool was developed to force me to do three things simultaneously. I have to put my audio script within the cell on the upper right, and you'll notice I've left the box rather small. At the same time, I must indicate what images are intended for the video screen, and simultaneously develop the computer-generated cues. In this way I am forced to design a message which will be delivered via audio, computer text, and on the video display. The tool helps me to design my lessons so that I use the delivery vehicle in a creative way. It too is not a very powerful, but a very useful tool.

I look forward to the day when I will be able to put aside my paper and pencil, and place myself in front of a computer terminal to have an authoring system automatically encourage me to make these choices. Then I will enjoy the benefits of the power of both soft and hard technology to create more effective instruction for learners. Looking to the future, that day is not very far away.

ANALYSIS AND DESIGN MODEL FOR FOREIGN LANGUAGE INSTRUCTIONAL SYSTEMS

PAUL MADARASZ

Defense Language Institute

Introduction

The development of an analysis and design model in the German language area presented here reflects the latest findings of systems science, as well as up-to-date theories and methods advanced by applied linguists, curriculum designers and practical language teachers at home and abroad. We will explore the potential use of educational technology (computers, video tapes, discs and so on) for the extension of the model, concentrating on the improvement of the processes of analysis and design as well as making suggestions for their use in the development of new courses. Finally, the model, designed specifically for use in the DLIFLC setting, can be cross-applied to foreign language training and teaching at other government institutes, in the private sector, and even in public schools and colleges.

This pilot model was created to produce a new German Basic Course more responsive to the needs of graduates occupying a variety of language-essential positions. In order to accomplish this, we followed the systems concept to training. Consequently, we started out to collect valid and reliable data on language-related military job performance requirements (MJPRs) by conducting a large-scale task analysis in the field with hundreds of job incumbents. In addition to this data collection effort, we were assisted directly by major user agencies who identified the training needs of our students. For instance, we have received explicit statements of training requirements from the Cryptologic Training System (CTS) and the U. S. Army Intelligence Center and School at Fort Huachuca, Arizona.[1] Also, DLI had a contract with Development and Evaluation Associates, Inc., to produce a series of pamphlets on methods of determining language objectives and criteria (Setzler et al., 1979). We have pursued all these avenues of task or needs analysis in order to make our new training program as job- or career-oriented as possible. In addition to performing job-related task analysis, we also collected exhaustive data on the linguistic and sociocultural components of the language tasks critical for effective job performance.

In our quest to improve the communicative ability of students, we searched for a more effective approach to writing and teaching a language course. The functional/notional concept and discourse analysis advanced by a number of European, British, Canadian, and American linguists and language teachers provided a number of good ideas in this area. We have received valuable input from the publications of the Council for Cultural Cooperation of the Council

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of Europe, the Goethe Institute of Germany, the British Council of Great Britain, and the Language Training Branch of the Public Service Commission of Canada.

Finally, we have also drawn on knowledge and experience gained at DLI while teaching thousands of students in dozens of languages for many decades. In creating the model, we aimed at establishing a balance of old and new concepts, methods, and practices. Following the Hegelian principle, we viewed old approaches as theses and new ones as antitheses. The "clash of ideas" resulted in the production of the German Pilot Model representing a synthesis, that is, a design that integrates the features of the old and new concepts into one coherent package useful to DLI's specific purposes.

The Systems Concept Applied

Before we report on the German Pilot Model, let us briefly discuss the systems concept that constitutes its overall framework. From the numerous systems models available, we chose as a starting point the one entitled "Inter-Service Procedures for Instructional Systems Development" (IPISD).[2] This military model, one of the most comprehensive in the area of systems science, was developed as a response to the Armed Forces' insistence on performance-based job-oriented training. The major proponent of the systems approach to training in the U. S. Army is the Training and Doctrine Command (TRADOC). As DLIFLC is one of its training centers, initially we were required to consult TRADOC documents when we began to develop new basic courses for the 35 or so languages taught at DLI. The attempt to apply the IPISD model to our training environment created numerous challenges, with most of the difficulties stemming from the fact that IPISD aims mainly at training in the so-called hard-skill areas such as driving tanks, assembling rifles, and firing missiles. Foreign language teaching is, however, considered a soft skill. Some other examples of soft-skill jobs in the military environment include counseling, management, leadership, and the development of foreign language skills. Because soft-skill tasks are more complex to perform than hard-skill, they require a more complicated analytical design to create an effective training system.

The medium, foreign language teaching, made our task very difficult. We know that the use of language is one of the most complex human behaviors. Its most baffling aspect is its tremendous productivity. For all practical purposes, there is no limit to the potential number of expressions in any given language. The problem then was how to devise a systems framework for this extremely soft skill that would include all data needed for effective course development and, eventually, for successful classroom instruction.

Several other formidable challenges arose in creating a model suitable for our purposes. Most systems designers work only with one job, but at DLI we deal with a multitude of defense occupational specialities (DOS's, military jobs). The student body represents over 300 DOS areas. How could we cope with the bewilderingly broad scope of foreign language requirements?

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A second formidable problem was the number and complexity of language skills for which DLI students have to be trained. Training is aimed primarily at acquiring a high level of proficiency in verbal communication, for example, engaging in formal and informal conversation. Additional training requirements include listening and reading for information, interviewing and interrogating, taking notes and transcribing, interpreting and translating. Consequently, we were faced with the difficult task of creating a matrix that would teach the necessary skills at the appropriate level of competency to holders of different DOS's.

The German Model

The magnitude of the task is now apparent: the creation of a training system capable of producing graduates able to perform foreign language-related duties in any and all job environments. As a first step in reaching that goal, we ascertained what language competencies were needed. This undertaking required rather sophisticated collection devices and, fortunately, on a trip to Germany in 1978, we were able to gather exhaustive data from job incumbents on language-related aspects of military job performance requirements (MJPRs). As mentioned before, we also received valuable input from major user agencies.

The greatest challenge, however, lay in dealing with a bewilderingly large number of military jobs and organizing relevant language requirements into an effective system. Resource and time limitations prohibited the development of special courses geared to the specific needs of all, or even major, DOS holders. (There were a dozen major ones in the German language area alone.) Instead, we clustered the DOS-oriented language requirements so that only one course had to be developed; yet, in order to make this one course relevant to all potential users, we had to base it on characteristics common to all major job requirements.

How were we able to design such an integrated course? To begin with, we decided to divide it into five phases to be taught in 56 weeks.[3] (FIGURE 1 shows the organization of the course.) The first two phases, called Common Core, were followed by a semiterminal or diversified segment (Phase III), culminating in a terminal or potentially multitrack segment (Phases IV-V). [See page 91.]

The Common Core

First, let's discuss the important concept of Common Core in some detail. Common Core means training in "general" language, implying that any corpus or body of language would be adequate training material for the early phases of any course. This assumption, however, is not quite accurate. In fact, we found that a body of general language elements which may be appropriate for a course taught at another government agency or in the private sector may not be entirely suitable for DLI courses (FIGURE 2), even though job requirements and linguistic and cultural content overlap. Consequently, for skills and competencies needed by DLI graduates in the German language area, only one body of language carefully selected in terms of the total course is satisfactory (see the German Basic Course block shown in FIGURE 2) to serve as a basis for the Common Core. (The Common Core constitutes introductory phases for our training curriculum.) The others are only marginally effective (see overlapping areas in FIGURE 2) or not effective at all. This way, a one-to-one relationship exists between the Common Core and the rest of the course constitutes one unbroken training continuum.

Now, how did we identify that body of language optimally suited to the entire German Basic Course as well as to its Common Core? As a first step we examined the total terminal language requirements for each major DOS. On that basis we then created the Final Job/Language Data Displays (end of Phase V) for each of the language duties and tasks identified as requirements in job performance.

We have selected the Integrated Job/Language Data Display (FIGURES 3-6) worked out for the duty "interviewing" as an example of the total system. The word "integrated" signals that these displays contain data representative of the major DOS's.

Take a close look at the first column, "Duties/Tasks" (FIGURE 3), which contains a detailed statement of language tasks in the actual job environment. All three of the major activities, "establish rapport," "conduct business," and "terminate interview," carry important messages for the course developers. Briefly, elements of the instructional materials must support these job performance requirements; otherwise, graduates cannot function effectively in their job environments.

Now consider the second major category, "Interaction." When developing training materials, it is important to know the characteristics of the people with whom our graduates will come in contact. The subcategories, "Participants," "Roles," and "Modes," contain significant linguistic psychological and cultural data for course developers. Appropriate training materials must be developed for each role and mode used by our graduates while interacting with participants in interview settings.

The subtitles of the next major category, "Conditions," are "Setting" and "Dimensions of Performance" (FIGURE 4). Obviously, it is important that the developer understand the environments in which the foreign language is used. Consequently, we accounted for spatial and temporal arrangements of performance as well as for psychological factors. "Dimensions of Performance" includes a number of language-related competencies together with other pertinent performance conditions.

The third major category is the self-explanatory "Criteria of Performance" (FIGURE 5). Naturally, the criteria established are geared to the expected job performance requirements listed under "Duties/Tasks" (FIGURE 3, Column 1).

Further down the line we encounter another major title, "Topics" (FIGURE 4, Column 3). We intended to use this category to reduce the infinite language corpus to a finite one. The best way to accomplish this was by identifying the most critical and frequently encountered topics in job situations.

Finally, the lists of Functions and Semantic Grammar (Notions) carry the model's linguistic load (FIGURE 6). These new concepts, recently advanced by linguists and language teachers in Europe, England and Canada, make language training more practical, meaning-oriented, and effective. They enable the learner to do something with the language, for example, to function effectively, both linguistically and culturally, in job-related interaction situations. By now we have identified all terminal requirements. The next step is to establish a gradual distribution of job-oriented training load throughout the entire course. This distribution is shown in FIGURE 7 where the inverted triangle in the center illustrates the degree to which the proposed basic course will be job-oriented. As you see, aspects of job-oriented training begin in the Common Core segment and continue throughout the course.

Now look at the Training Profile (FIGURE 1) again. At the bottom you see the Common Core segment (the first two phases), showing no differentiation in training. All students receive the same instructions. Although job-oriented training of a general nature begins in Lesson 1, the first division of training occurs in Phase III. We provide for a separate CTS/HUMINT/Special Forces track, mostly of East German content and context, even though the HUMINT types also need training in the West German context. There is also a purely West German track for the police/administration types, combat arms people and so on.

Further differentiation of training takes place during Phases IV-V. For instance, the HUMINT/Special Forces track is separated, and more job-oriented training is projected for both. In spite of multiple segmentations, the units of the course are preserved as the differentiations show mostly in the area of skill training. For instance, CTS students will receive more training in the receptive skills (listening and reading), while task analysis indicates the need for HUMINT students to be trained primarily in productive skills (speaking).

Potential Computer/Media Support for Model

As you have seen, the German Model represents a rather complex instructional systems design. As soon as the cross-application of the model to other language projects began, the need for extension and refinement by including computer and media support became apparent. Thus we proposed to make the model an even more useful tool for course writers in two areas: (1) to employ computer assistance for the collection and analysis of data as part of the front-end-analysis effort; and (2) to use a computer and other media to support the design and development phases of the instructional systems continuum.

As concerns the first point, we have already employed a computer for certain statistical operations. The task analysis questionnaires for the French, Spanish, Italian, Greek and Japanese language courses were constructed so that data could be evaluated and tabulated on a computer.

This was only the first step, however. There are a number of other documents in the analysis package that can be processed by computer. Because the German Model was conceived as a pilot project with potential cross-applicability to other foreign language projects, we considered the German analysis documents as generic models for other language areas. For instance, the Integrated Job/Language Data Display in FIGURES 3 through 6 has already been adjusted to training requirements established for other languages. The adjustment was made on the basis of the target population analysis and the task analysis data collected in the field. So far, we have employed professional (subject matter experts [SME's]) and clerical help (typists, statistical clerks) to do the job using traditional methods. Necessary adjustments, however, can be accomplished on a word processor or computer terminal, the idea being that the work load can be lessened by using electronic devices to compile and adjust already-stored data.

The same procedure is used to deal with the content/topical catalogs, functions/notions catalogs and, eventually, other documents. In the case of the content catalog, once the generic document is produced, the topical areas are adjusted on the basis of the results of data collection. The functions/notions catalog is also produced first in English in generic forms, and then adjusted and extended to fit the new target language sociocultural and grammatical frameworks. In the final step, language examples are added in the target language. Although this procedure is more complicated than the adjustment of the Integrated Job/Language Data Display or the content catalog and thus results in longer work time, computerization does result in considerable savings.

Predictably, we are not alone in working to make the Instructional Systems Development process more economical. In the article entitled "CASDAT: An Innovative Approach to More Effective ISD," Fritz Brecke and Art Blaiwes (1981-82) report their efforts to train aircrews. Although the subject matter is far removed from our field of interest, the procedures they employ are of interest because in the search for greater economy the authors adopted procedures quite similar to our own.

A brief description of the training situation follows. The acronym CASDAT stands for "Computer-Aided Systems for Developing Aircrew Training." The system, in the words of the writers, "allows semi-automatic generation of task lists, objective hierarchies, media selection, syllabi and lesson specifications" (Brecke and Blaiwes, p. 271). The key phrase here is "semi-automatic generation" of certain documents, which is also our aim in computerizing the German Model.

Brecke and Blaiwes' hypothesis is that enough commonality must exist among various aircrew jobs to warrant the development of a common data base. They actually found a "clearly discernible common thread" among the tasks and produced a generic list that SME's could customize to fit specific aircrew positions and aircraft. The developers select those items on the generic list that pertain to a specific job or aircraft while employing a computer text-editing system.

Our generic model serves basically the same purpose in cross-applying the German Pilot Model to other language areas. The difference lies in the degree of complexity of the two jobs. Even though we have a generic model, the process of adoption/adaptation and extension/deletion of the components, furnishing of entirely new elements (such as target language examples), is an involved process. Nonetheless, substantial savings are realized by using a generic model, and even more by employing the services of computers and/or word processors.

In the area of design and development of instructional materials, the employment of educational technology (media) is even more promising. Using computers, we are now planning a number of scenarios based on job and linguistic data contained in the Integrated Job/ Language Data Displays to serve as frameworks for the development of interactive exercises. To illustrate this point, we refer to the Summary Flow Chart (FIGURE 8) which shows the process in the area of foreign language instructional systems development. Two major bottlenecks exist in the flow of activities. One occurs at the decision point, "Determine Scenarios"; the other at the point "Determine Learning Tasks." Course writers find it difficult to deal with the complexity of this data bank at these two juncture points. Using a computer to sort, for instance, scenarios, at the first bottleneck, accelerates the process considerably and results in clearer scenarios that include all potential participants and role-playing situations staged in a number of settings with a variety of topics. These computer-produced scenarios supply the course writers with an abundance of ready-made curricular building blocks. The second bottleneck proves to be even more perplexing for most coursewriters. Again the computer compiles the thousands of functional/notional, grammatical, cultural and other elements into manageable data packages for use in the course.

One potential use of computer and videodiscs as pertains to communicative functions should be mentioned here. The goal of training for functions is to place students in authentic situations where they effectively interact with each other using high-frequency language phrases and cultural elements appropriately. In other words, we are aiming to develop sociocultural as well as linguistic competence in our students in preparation for "real world" situations, that is, the use of foreign languages in their job environments.

The article "Developing a Measure of Sociocultural Competence: The Case of Apology" (Cohen and Olshtain, 1981) propounds the idea that media, especially computer-assisted videodiscs, can be very profitably employed to instill sociocultural competence. The article deals with testing such competencies, but its thesis is easily transposed to everyday training situations.

The authors picked a productive language function, apologizing, for their investigation. Other choices for potential functions include agreeing/disagreeing, expressing likes/dislikes, satisfaction/dissatisfaction, approval/disapproval and so on. Cohen and Ohlshtain conceive that around these functions a rich repertoire of language can be assembled and exploited for training purposes. Extending this concept, we propose that by placing the students in the framework of apologizing, for instance, a number of high-frequency, linguistically appropriate language expressions can be introduced and practiced together with sociocultural clues, language registers, styles, vocabulary choices and even topics. The richness of this language corpus lends itself to the development of a great variety of exercise types. In the area of receptive skills, among others, we ask the students to identify the functions used in a script for a video tape or disc and to write down or repeat the language exponents (examples) used to express the functions. In the active or productive mode the videodisc as silent still or motion pictures acts as stimuli encouraging the students to supply the appropriate linguistic, cultural and stylistic utterances in the computer and to check them against the real thing when the audio is played with the pictures. Finally, we ask the students to volunteer further functional categories and exponent/language samples appropriate to the situation. This list is checked against one given on the computer screen or discussed by the teacher.

These are only bits and pieces of the total design for the use of computer and other media. We believe, however, that in the future more practical use can be made of the new, increasingly sophisticated computer and video hardware which seem to flood the market. Therefore, it is imperative for curriculum designers to give serious attention to the development of software in anticipation of the pending "revolution" in hardware production.

Cross-Application of Model Outside DLI

Finally, we would like to show how the model can be cross-applied to foreign language training and teaching in the private sector as well as in schools and colleges. First, let's focus on training in the private sector.

A language corpus designed to meet the needs of the business community is also appropriate for military use. We have to go through the identical steps followed in the development of the German prototype: collecting task analysis data, producing Integrated Job/Language Data Displays, developing topical lists, compiling function/notions catalogs and so on. Task analysis conducted, for instance, in a business setting, may establish some language tasks similar to those used by the military such as interviewing (local applicants in a foreign country), interpreting (for a visiting dignitary, company president), translating (for local newspapers, magazine articles relevant to the company's business), and conducting liaisons (keeping in touch with local business leaders). Other tasks specific to business interests include negotiating deals, giving sales talks, and demonstrating new products.

On the basis of this language corpus, we can design a Common Core segment appropriate for foreign language courses developed for all types of businesses. Special follow-up training to account for the needs of various branches such as financing, banking, foreign trade, and others are included. Again, whether used for training by business or the military, the same organic relationship exists between the Common Core and the diversified and specialized follow-up phases.

The same pattern is developed for industry. Again, a broad Common Core segment is followed with tracks to take care of the multitude of special interests (FIGURE 7).

Although not identical, the Common Core segments for business and industry overlap. In fact, some areas also overlap with the military model. Yet, the Common Core segments designed for business and industry represent the optimum selection of language corpora for the developers for the following courses.

All in all, while the model can be used as an organizer for business and industrial curricula, the systems components have to be developed independently to reflect the needs of various communities in order to produce graduates capable of functioning in a foreign environment.

This systems model is also suitable for use in an academic setting. If, for instance, foreign students who lack the necessary English competencies want to enroll in American universities, the systems model is easily adjusted to create programs to prepare them for their studies. Again, the critical language tasks to be performed by students should be clearly identified. They may include skills such as speaking extemporaneously, writing term papers, note-taking/gisting, reading for content, and using the dictionary.

Next the language corpus is established according to major subject areas such as the social and natural sciences and business. If, for instance, we selected natural sciences, we would develop the Common Core segment for natural sciences and follow up with special training in various subgroups such as botany, zoology, and biology.

Conclusion

As you have seen, applying the systems principle to the creation of an instructional systems design in the area of foreign languages is not a simple task. On the other hand, it is certainly not an impossible undertaking. The concurrent integration of new linguistic and sociocultural concepts into the overall curriculum design adds to the complexity of the task. Yet, in spite of all difficulties, we were able to mold these widely divergent elements into a workable system. This effort is now paying dividends: the German and other new courses being developed according to this design show signs of great promise. Thus, we are confident that once put into practice the approach will effectively prepare our students for their language-related duties and tasks. We realize, however, that the model should be supported and extended by the inclusion of media, and that all three steps of the instructional systems model--analysis, design, and development--wil benefit significantly by such inclusion. Therefore, our continuing effort at DLI will focus on these aspects. Finally, we also have demonstrated the potential application of the model in the private sector and in schools and colleges. We hope that our efforts at DLI will be of some use to course writers and teachers engaged in the teaching and training of foreign languages elsewhere.

NOTES

1. The CTS document is entitled "Terminal Learning Objectives at Defense Language Institute (FLC) for Cryptologic Language Students," produced by the USAF School of Applied Cryptologic Sciences, Goodfellow Air Force Base, Texas, 1977. The others are official communications received from the U.S. Army Intelligence Center.

2. This document was prepared in 1975 by the Center of Education Technology at Florida State University for the U.S. Army Combat Arms Training Board. Although it is the officially endorsed systems concept for TRADOC schools, its use is not mandatory.

3. This time estimate is based on the objectives given to us by the CTS Community and our own task analysis effort.

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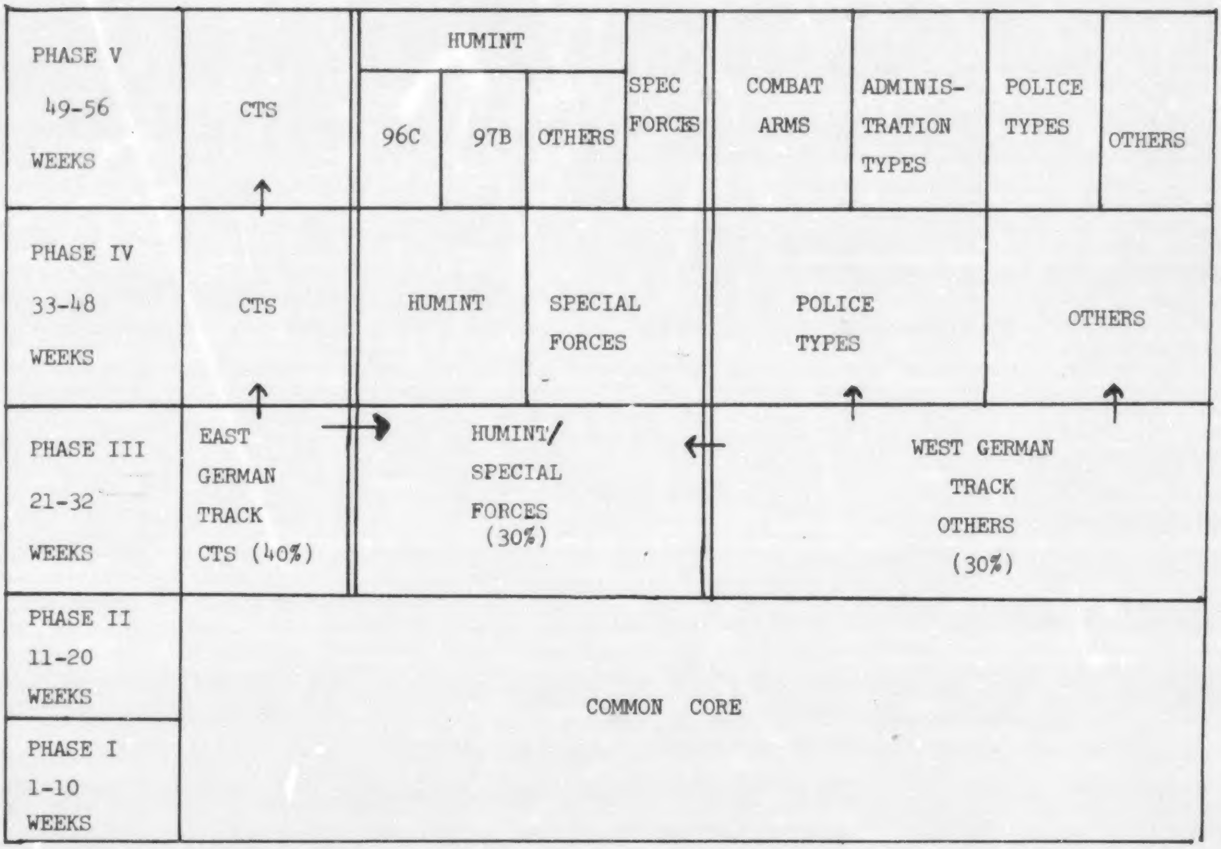
FIGURE 1

GERMAN BASIC COURSE

PROFILE



<table>
<tr><td rowspan="2">PHASE V
49-56
WEEKS</td><td rowspan="2">CTS</td><td colspan="3">HUMINT</td><td rowspan="2">SPEC FORCES</td><td rowspan="2">COMBAT ARMS</td><td rowspan="2">ADMINISTRATION TYPES</td><td rowspan="2">POLICE TYPES</td><td rowspan="2">OTHERS</td></tr>
<tr><td>96C</td><td>97B</td><td>OTHERS</td></tr>
<tr><td>PHASE IV
33-48
WEEKS</td><td>CTS</td><td colspan="2">HUMINT</td><td colspan="2">SPECIAL FORCES</td><td colspan="2">POLICE TYPES</td><td colspan="2">OTHERS</td></tr>
<tr><td>PHASE III
21-32
WEEKS</td><td>EAST GERMAN TRACK CTS (40%)</td><td colspan="4">HUMINT/ SPECIAL FORCES (30%)</td><td colspan="4">WEST GERMAN TRACK OTHERS (30%)</td></tr>
<tr><td>PHASE II
11-20
WEEKS</td><td colspan="9" rowspan="2">COMMON CORE</td></tr>
<tr><td>PHASE I
1-10
WEEKS</td></tr>
</table>

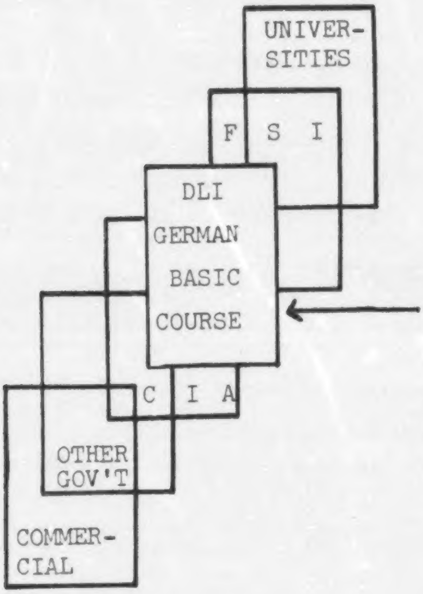
Abbreviations:

CTS	Cryptologic Training System
HUMINT	Human Intelligence as contrasted to Electronic Intelligence
96C	DOS for Interrogators
97B	DOS for Counter-Intelligence Agents

FIGURE 2

POTENTIAL SETS

OF COMMON CORE ELEMENTS



THE OPTIMUM BODY OF
LANGUAGE (CORPUS)
FOR THE
GERMAN
BASIC
COURSE

FIGURE 3

INTEGRATED JOB/LANGUAGE DATA DISPLAY

INTERVIEWING

DUTIES/TASKS	INTERACTION		
Procedures	Participants	Roles	Modes
1. Establish rapport - Greet interviewee - Carry on limited small talk 2. Conduct business - Establish identity of interviewee - Explain the nature of interview - Ask questions on topics selected - Ask for further details, explanations, clarifications as needed 3. Terminate interview -Thank interviewee for cooperation - Set up new time, location for the next interview	1. Legal status - refugees - deserters - political dissidents - etc. 2. Place of origin - East Germany - Soviet Union - East European countries - etc. 3. Socio-political background - Social status - Political affiliations 4. Level of education, training	1. Role set identity - individual-to-individual - adult-to-adult - male-to-male - male-to-female - female-to-male - etc. 2. Types of role a. Psychological roles - equality - neutrality - empathy - persuasion - suspicion - etc. b. Social roles - stranger-to-stranger - official-to-private person - etc.	1. Linguistic interaction Types - face-to-face communication 2. Cultural Interaction - use of body language - use of culturally appropriate expressions - etc.

FIGURE 4

INTEGRATED JOB/LANGUAGE DATA DISPLAY

INTERVIEWING

CONDITIONS		TOPICS
Setting	Dimensions of Performance	
1. Location - office in barracks - office in other locations - etc. 2. Temporal factors - time of job performance - duration - frequency 3. Psychological atmosphere - friendly - cooperative - relaxed - strained - tense	1. Size of utterances 2. Range of language use - registers - styles 3. Special features - professional/military jargon - slang expressions - dialects 4. Complexity - Sentence construction 5. Speed of communication	1. Daily routine - Hosts and guests - Public/private transportation - Family life - etc. 2. Society - Social classes - Social interaction - Labor organizations - etc. 3. Political organizations/processes - Parties - Political views - etc. 4. Geography/climate 5. Education 6. Science/technology 7. Military life/organizations - Branches - Order of battle - Logistics - Weapons - Troop movements - Paramilitary organizations - etc. 8. Law enforcement 9. Many other topics

FIGURE 5
INTEGRATED JOB/LANGUAGE DATA DISPLAY
INTERVIEWING
CRITERIA OF PERFORMANCE

1. Establish Rapport

Expected Performance: Interviewer will greet source, make introductory remarks and carry on small talk while using language features and body language appropriate for the source's official position or rank, social status, level of education, sex and age.

Criteria:

1. Source will comprehend all utterances of interviewer without need for repetition.
2. Interviewer will use the appropriate language registers and styles at all times.
3. Interviewer will maintain a normal rate of speech while addressing and/or greeting the source and while making introductory remarks or carrying on small talk.
4. Interviewer will select the appropriate functions and notions in support of the topics discussed, and the language exponents appropriate for the setting and psychosocial roles required by the communicative tasks.

2. Conduct Business

Expected Performance: Interviewer will obtain all data of interest to U.S. agencies.

Criteria:

1. Source will comprehend all pre-prepared utterances pertaining to the identification of source, explanation of the nature of interview, questions on topics, etc., without need for rephrasing or repetition.
2. Interviewer will deliver all pre-prepared utterances without pause.
3. Interviewer will not pause longer than 5 seconds in a 60-second segment while delivering spontaneous utterances.
4. Source will comprehend 9 out of 10 unprepared (spontaneous) utterances without need for repetition or rephrasing.
5. Interviewer will comprehend 8 out of 10 utterances of source without need for repetition or rephrasing. Length of utterance will not exceed 50 syllables.
6. Notes will contain all significant data in answer to standard questions such as who does what, where, when, etc.?

3. Terminate Interview

Expected Performance: Interviewer will express thanks and appreciation, set new time and place for the continuation of interview and make closing remarks while using language features and body language appropriate for the source's official position, or rank, social status, educational level, sex and age.

Criteria:

1. Source will comprehend all utterances of interviewer without need for repetition.
2. Interviewer will use the appropriate language registers and styles at all times.

(For 3 & 4 see Establish Rapport)

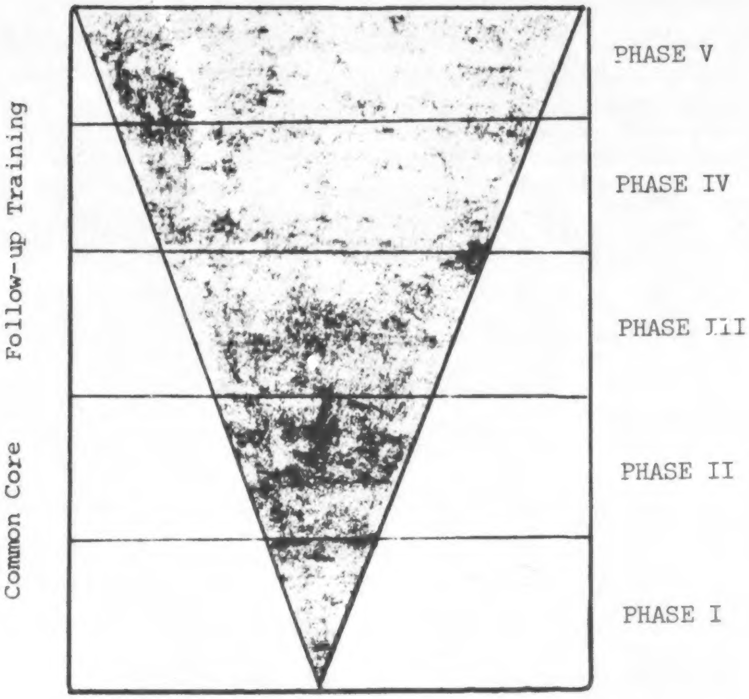
FIGURE 6
INTEGRATED JOB/LANGUAGE DATA DISPLAY
INTERVIEWING

FUNCTIONAL COMMUNICATION		SEMANTIC GRAMMAR (NOTIONS)	
Categories	Examples	Semantic Categories	Grammar Points and Examples
. Perform official/ social interaction -Greet formally/ informally	Good morning, day, evening Hi, Hello	1. Temporal concepts -Points of time	-Nouns + morning + day + evening -Direct object (word order) (I wish you a good morning.)
-Introduce yourself, others	I am + NP My name is + NP This is + NP Pleased to meet you. What is your name?	2. Present reference	-Simple present of copula + I am
-Open conversation	VP + glad you came.		
-Carry on small talk by inquiring about a family	How are you today? How is your family? (wife, sons, daughters, etc.)	3. Possessive relations	-Possessive pronouns + my + NP + your + NP
		4. Other deictic elements	-Demonstrative pronouns + this, these + that, these
. Manage interview -Identifying persons + names, ranks, titles	Your name is + NP Your rank is + NP You are + NP...(Name) You are + NP...(trade, profession, occupation)	5. Personal Identification -Names + first name + last name + initials -Mr. + NP (proper name) -Mrs. + NP (proper name)	-Peter, Paul -Jones, Smith -W. R., E.
+ locations + addresses	You are from + AP You were born + AP You lived in + AP	-Terms of address if no proper name is used.	
+time, duration	from + TA to TA during + TA (year, month...)	-Mr. + NP (proper name) -Mrs. + NP (proper name)	-This is Mr. Paul Jones. -This is Mrs. Jones. -Sir, Miss

FIGURE 7

EXTENT OF JOB-ORIENTED TRAINING

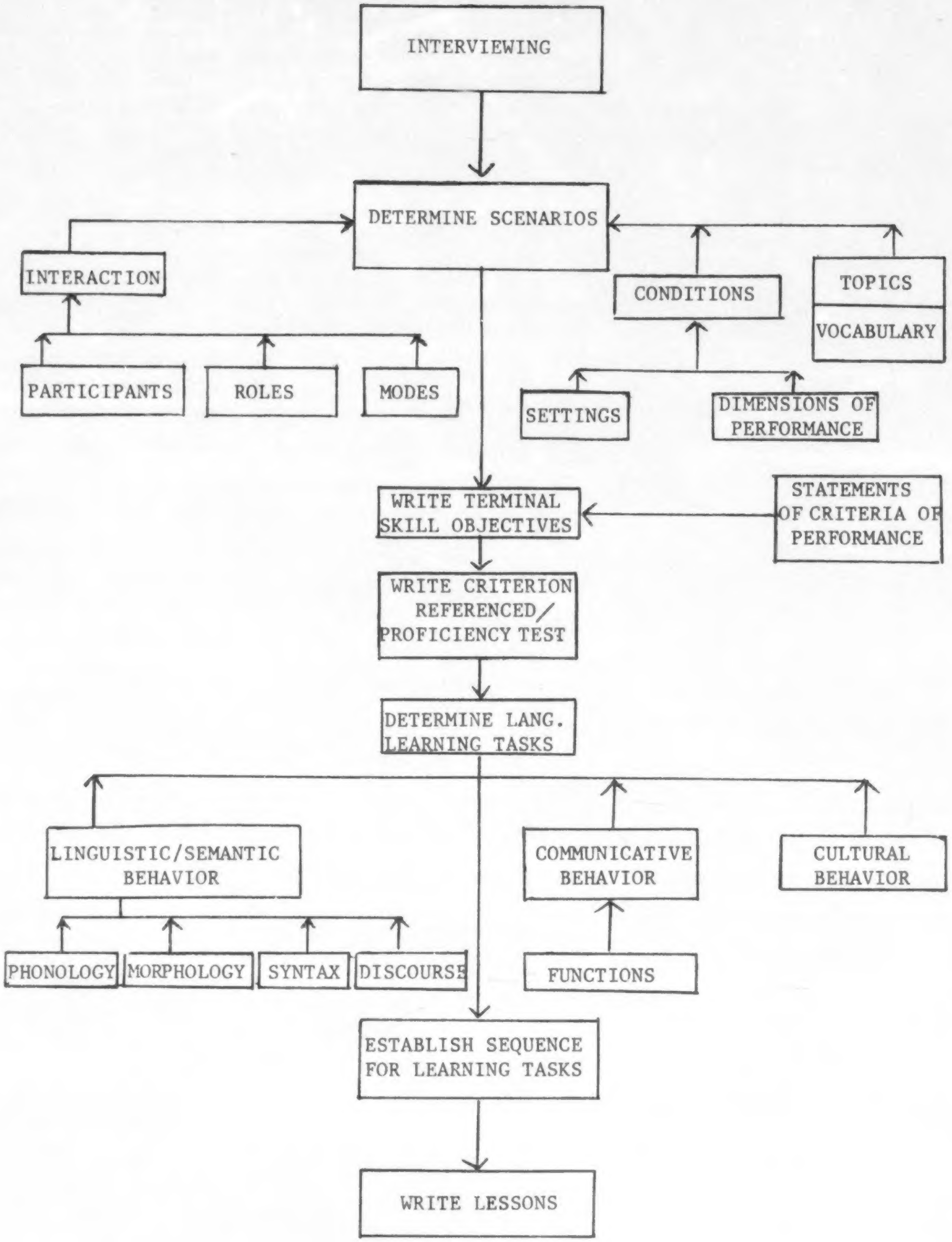
GERMAN BASIC COURSE



NOTE: The shaded area indicates the extent of job-oriented training in each phase.

FIGURE 8

SUMMARY FLOW CHART


INTERVIEWING
DETERMINE SCENARIOS
INTERACTION
PARTICIPANTS
ROLES
MODES
CONDITIONS
TOPICS
VOCABULARY
SETTINGS
DIMENSIONS OF PERFORMANCE
WRITE TERMINAL SKILL OBJECTIVES
STATEMENTS OF CRITERIA OF PERFORMANCE
WRITE CRITERION REFERENCED/ PROFICIENCY TEST
DETERMINE LANG. LEARNING TASKS
LINGUISTIC/SEMANTIC BEHAVIOR
COMMUNICATIVE BEHAVIOR
CULTURAL BEHAVIOR
PHONOLOGY
MORPHOLOGY
SYNTAX
DISCOURSE
FUNCTIONS
ESTABLISH SEQUENCE FOR LEARNING TASKS
WRITE LESSONS

MULTILINGUAL PROCESSORS

CARL LEHFELDT

Acurex

The subject of my paper is "Multi-Lingual Processors." The emphasis here will be on general purpose processing in a foreign language, not in treating language as data, but in fact using the language of interest in the form that the computer understands and deals with as a natural order of its logic. The major requirement of a processor that talks in other than English is an entry display system that is not restricted as to character form. I should say symbol form. I'll use the word symbol here; character is misleading. One way to implement that is a system called bit-addressable graphics. Now there are many of these systems coming out on the market now. Currently we are using them mostly for graphics and not for dealing with this language problem. Better-addressable graphics means that the screen, or what you see on the screen, is a snapshot of a section of memory. And in fact you are taking a picture of that memory at about 60 times a second. And for the sake of this discussion, I'll describe an existing system that I designed and talk a little bit about the rudimentary software structures, about what happens when you press a key, how the symbol gets there, in both English and other symbols.

FIGURE 1 It's a real straightforward CPU Z80. Some ROM to contain the keyboard monitor, which is the simplest intelligence you can give most of these machines, and in this diagram also contains the symbol patterns. General purpose RAM consists of 32K of this. The video control is what takes the snapshot of about 16,000 bytes of this memory. Keyboard, trailboard, normal stuff. The video control here is the important issue, takes the contents of this memory, maps it to the cathode-ray tube, the terminal, the tube.

FIGURE 2 This is just a graphic representation of the memory map. Main RAM extends from zero to 7FFF, that hexidecimal notation: the video RAM area, keyboard monitor and symbol patterns. The idle state of a CPU, particularly the one that's waiting for the operator to do something, is interrogating the keyboard. The keyboard is merely a matrix of switches, and each key has a unique position in that matrix. As the CPU interrogates the keyboard, what gets returned is a unique numerical value based on the active key. What you do then is take this value, use it to form an address, providing that it's a printable character, maybe a control character, to find the pattern of interest in either the ROM in this case, or it can be RAM, or it can be completely software-driven. It does not have to be dedicated. And then place the appropriate pattern in the video RAM; simply by turning certain bits on and certain bits off, you will see some symbol on the screen.

FIGURE 3 This is a very simplified flow chart of the process. Simply get key value, display it. Are you in that context? Is it a command function or are you supposed to be doing something else with that value? But if you're displaying it, you merely go get the symbol pattern, move that pattern to the random access memory, update the cursor position to tell you where to put the next character, of course, and go back and get another one. Not much else to do at that point. In this particular structure the screen memory correspondence is location 8,000 hexidecimal, is top most, left most, eight bits, first eight dots on the screen. Eight thousand and one is the next eight bits, on down the line until there are 80 bytes of information on that line. Then we go on to the next horizontal raster scan; well I didn't compute what value that was, but it's 80 decimal more than where we started. Again, there are 640 dots in 80 bytes, 192 rows in the structure that I've played with so far. In order to write a symbol pattern, let's say we're going to place a character in an 8x8 matrix on the top left position on the screen. Eight bytes, first position of the first line, eight bytes in the next line directly below it. Otherwise, you wouldn't recognize what you wrote out there. So when you go get a pattern, you go get eight bytes of data, but you must place it at an 80-byte interval in memory. The result will be that figure: the figure of interest.

FIGURE 4 which is just the red eight-bit. Let's just say that's character, and in this particular circumstance in that symbol pattern of interest, we turned all the bits on. The result would look like that, greatly magnified, of course. Now the first overlay. By turning off a few bits, we get some intelligence. Now this logical structure is useful for any particular pattern that could be contained in eight bytes of data. Second overlay. This is the Greek figure "phi," so if your computer understands Greek then this is a useful symbol for it. Next overlay. This is the Russian equivalent of a "d," I believe. Again, if your machine understands this particular symbology or symbol set, then you have something that understands Russian symbols.

FIGURE 5 This is a 24x24-bit matrix. Unfortunately, it is not scaled very well, but we'll make do. What that means is that this would be the top raster line. You would get three bytes to define that--24 bytes long. And now the overlay. That is a crudely done, and it can be done better by somebody who is a better artist than me, Chinese character. Now the thing you'll notice, other than the matrix size, is that the logical principles involved here are the same. It's merely symbol manipulation. In English, Greek, Russian, Chinese, any language that uses symbols, and I can't think of any that don't offhand. Historically, there have been some languages that had no written language, but I don't think those are extant in the world today. So we can display, by the simple logical structure, symbols of varying sizes and types and meanings. Now to make this truly useful, in terms of general-purpose processing, it's a fairly straightforward process. You need the symbols of interest, what size matrix you need to display that, some symbol sets required, and this is an example, more information than others. You need to set up your

key correspondence. Now Chinese is a special case. There are several different ways of dealing with the ergonomic factors of entering this language. For the sake of discussion, we'll stick with the telegraph code which is just numerical digits that correspond to a given symbol in the Chinese language. For more conventional languages, alphabetic languages, we need to determine the key correspondence. You push a key. You get a symbol. You just simply need to make that connection and program it. You need to set up ASCII-like codes for your symbol set. Now ASCII is the American Standard Communication Information Interchange Standard. It doesn't exist for too many other languages or something similar. Somewhere along the line, that needs to be decided. And then the next thing you do is convert the assembler symbols to your symbols of interest. You convert your editor commands and messages to the new symbols. You than enter that, reassemble it; you have a basic machine that talks in a language other than English and in fact, all of a sudden it does not understand English at all. Does not know about English. If you gave it English symbols or tried to, it would probably go off in a corner and pout, and give you an error message in a language you may or may not understand. In fact, it's much the more difficult part of these kinds of things, that translating the user manuals--long, arduous, tedious tasks, but creating a computer that operates like any other computer with a different symbol set is fairly straightforward. After those seven steps, the process can be continued. You now have an operating assembler and editor. Now you can enter things like compilers, interpreters, create high-level languages with simple editing processes. You do not have to rewrite your code. You merely change its symbol set and its messages. That's the extent of the point I have to make. Being a hardware designer, I may have used terms that some of you may have understood, or may not have, as the case may be.

METHODS OF USING MICROCOMPUTERS IN FOREIGN LANGUAGE INSTRUCTION

JOHN RUSSELL

State University of New York, Stony Brook

Although I usually wing these things, last night I actually stayed up for an hour writing a very beautiful outline--which I lost today. Therefore, I will again be winging things.

When I explained to my chairman that I was going to disappear for a week, she said, "Ah, you are going to an Expertenseminar." I tried to explain to her that if I was going it was not an Expertenseminar, but she insisted on calling it that. I assure you that you have before you a representative of the laity, "the view from the trenches" or whatever you want to call it. If I presume to appear here, it is as a consumer advocate or--that horrible term--a resource person.

My qualifications along the latter line are fairly good in that I was in on the first wave of CAI in the mid-sixties when IBM developed its 1500 system and for its own reasons selected Stony Brook among other institutions for experiments with language learning. At our school it ended up with the Germans, of course: they're compulsive; they'll do anything. And ultimately it trickled down to a colleague, Ferd Ruplin, and myself. The program was introduced originally by wire to Yorktown Heights, some 80 miles away, and employed teletypes. That was fairly horrible. Then we switched to CRTs and an in-house 1500 with about 24 stations running off it.

What IBM had done was to get the rights to Harold von Hofe's *Der Anfang (Revised)*, and had taken the drills out of the book and put them on the computer. We told IBM immediately that this was wrong for two reasons. One, the book will go out of print. Two, what is the TA going to do? Well, the TAs did what TAs do; they did the drills in the book. Then the kids went to the computer lab and found the same drills, and within weeks everyone was crazy. But it was introduced, originally on a voluntary basis with predictable results. Some did the work, some didn't. Nonetheless, the feedback was so good that we decided to go with it, and did so.

Fortunately for the experiment, in '69 von Hofe's book went out of print, as we had so wisely predicted. At that time I sat down and wrote a very similar course called CAI-DEUTSCH for the IBM 1500, which we thereafter used and used, we think, with great success. We learned many things from these experiments. One was: don't tie the CAI to a specific textbook; that's just not very bright. Two, we learned that students like CAI. They like it better than the teacher for what it can do for them as a tutor, and so we had used it. We also learned, or had various predilections reinforced, that with post-pubescents one should not fool around and play games.

This is a point on which honest men can disagree but I have found in teaching college students and adults--as someone put it yesterday--that any program which begins "What's your name?" is a puke. It works once and then you'd best forget it. I'm of the same opinion concerning color. I don't think Germans use yellow for the accusative and blue for the dative. They don't. I have the same feeling about sound. If the student gets 90 or better, perhaps the computer can play "Deutschland über Alles" and with 50 or less he can hear the "Marseillaises." This is quite doable but it's funny only once. Adults want to move on. They learn deductively. They want to know the rules. They want to manipulate them.

Fine, things were going great and then, of course, came the financial crunch. It was an early visitor to Stony Brook as I learned when the administration unplugged the computer in '73 or '74 and told me of the decision only after the fact. Well I sat and smoldered because I thought CAI was a tremendous technique, doing a far better job of teaching certain things than did I or my colleagues or most anyone I had ever seen. I was fortunate to have at this time a student, a very bright young lady, who got her A.B. in math and German, went on to get an M.A. in German, and then walked across campus and got an M.A. in electrical engineering. She is now a professional programmer but was not at the time when we developed the program you are going to see a demonstration of. This is a course called MICRO-DEUTSCH--I started to call it HAUSTIER-DEUTSCH, but that sounds a little arch--with which we essentially replicated what we had had with IBM. Again, IBM had simply taken the drills from the von Hofe book, which were without exception of the substitution/transformation type. When I wrote the CAI-DEUTSCH text, I had asked IBM to create a second type of drill, which is item-ordering, i.e., essentially reading slots from left to right and telling the student when he's made a mistake and what rule he's violated. When we went to the microcomputer, we also created a third type of drill, the simplest type--so simple that even I programmed it--which is tabular, for plugging in various things. You will see this in a minute.

We can go here into problems of micro versus big system. I happen to be a minimalist. Maybe I was on the leading edge in '65. I'm now on the trailing edge because I'm in the SUNY system and there's no money. Maybe your schools are all well-funded but I don't see any money coming down the road for quite a while. I also am against the big machines despite the wonders they can do because, in my experience, the bigger the machine, the more unique the programming and the less portable the program created. I find this sort of stupid. I think we should all go to micros where I could send you a cassette of my program, and if you don't like it, you can sit down and change it to your liking in a matter of minutes. In point of fact, with the PET you can save the program and easily substitute a different target language, which is one reason I went to it. The good people here have finally found me one, which was lucky since most micros seem to flourish in specific regions. Despite their unbelievable sales force, Commodore has one such pocket on Long Island where I live. All the grammar schools have stacks of PETs. SUNY-Stony Brook is also a PET shop rather than an Apple orchard. I would probably have gone wherever my colleagues led but fortunately it was to the PET. The beauty of this micro is not only that it is cheap, but also that it has all of its graphics on one chip. As far as I am concerned, graphics are the big hangup with computers of whatever size or make. As a language teacher, I do not want to have my students write *ae*, *a*-semicolon or *a*-anything else if they're supposed to be writing an a-umlaut, and the same is true of the other foreign characters. With the PET, you can pop the manufacturer's graphics chip and sit down to a somewhat laborious but one-time task of creating an EPROM with whatever characters you want. Unfortunately, the PET which the conference found has the graphics chip soldered in. I'm not going to break 24 points to get it out and put mine in. No two PETs are alike; usually the graphics chip is not soldered in and you can easily remove it. If I could have done that, I could show you, with a gadget called a space-saver, how we have Hebrew, Cyrillic and so forth available at the flip of a switch. Very handy.

Let's go to the program. What you are going to see will not have the umlauts. I'm showing you the PET version because it's faster (than the Apple) and also because I have a short demo of it, illustrating the three types of drills. You can read the text or, if you can't, it's saying that MICRO-DEUTSCH consists of 28 lessons, 24 of which are teaching and four testing. Each of the 24 teaching or learning units consists of five modules which are a mix of three types of drills, the first of which is substitution/transformation. The student is given a sentence and a cue telling him to do something with it. I also insist on upper and lower case which Jim Pusack, for instance, does not. The computer will correct for that. It simply matches strings and is not very sophisticated. This was written for 8K, which you no longer can even buy. It is an antique, of course; 16K is the bottom of the heap these days. As said, the program matches strings and where they no longer match, everything will be out of sync and be printed in reverse as wrong. However, a high number of mistakes, more than half, are single letter mistakes so the computer looks much smarter than it is. Of course, the confirmation messages would be in the target languages; that one would be *Endlich*! or some such. I got tired of one set and ended up searching for new trinities such as *Kommendabel*! *Passabel*! and *Miserabel*! It got rather desperate. If you can read it, the warmth of the message that you receive when you get the right answer depends on the number of tries you take. If you miss three times, you're shown the correct answer, but the item is recycled. You end up having to get everything right.

We're going on to the second type. If you can't read it, it says it's simply an item-ordering drill. For the purposes of variety and for speeding things up, I ask the student only to enter the sequence of the presented items to form a sentence of the type desired in the drill. Here I think I was introducing the student to weak verbs that have *sein* as the auxiliary and asked them to form a yes/no question. And again the computer reads the answer from left to right, by slots so to speak, and hopefully sends appropriate corrective messages. Module 3 is simply tabular and can be used for vocabulary drill by asking the student to supply, e.g., the plural, the proper article, and/or the English equivalent. In the example here I ask the student to supply the preterite and present perfect of verbs, or Imperfekt and Perfekt, as you wish. The nice thing about this routine is that the computer reads for both auxiliary and perfect participle. If you get the wrong auxiliary, it will show you it's wrong; or if the participle is wrong, it will show you that too.

Of course, each module is graded. I originally showed a score after each module but the students said, "That's a hassle. Get off my back!" So now I give them a score at the end of the lesson, for their information. Another lesson learned from the IBM experience was "No data, please!" I think individual item analysis is something for future doctors of education or psychology so they can get their doctorates. I don't think it helps or is of any use to know how long it took for people to answer a certain item correctly because we don't know how much they learned in doing so. And I also believe that since you are down in the trenches, the troops can talk to the officers and vice versa. If you want to know whether you have a good lesson, ask the students. If you want to know if they're having trouble, ask them. Don't try to interpret statistical data, because you don't know what you're doing. None of us does. (Had I my chip in there, you would be seeing a Spanish sentence with all the diacritics, and a Polish sentence.)

Where do I think I'm going in the future? I don't know. One nice thing at Stony Brook is that we have a new degree called the doctor of arts in foreign language instruction where the students are asked to think about language rather than write yet another dissertation on Goethe. I have students preparing computer materials in Swedish, Danish, French, Italian and Spanish, of course; Polish and Russian are upcoming, I think. As for further work in German, what I would like to do if I were smart enough is to write about ten different courses for second year German. Let the class do what it always does, which is review grammar and study general readings. But let the student review grammar with a purpose: if he wants to major in physics, let him do all his drills using the vocabulary appropriate to physics. Someday I may get around to that, maybe not. I certainly am not an expert in ten fields or in any field.

VIDEO RETRIEVAL SYSTEMS FOR FOREIGN LANGUAGES

SUE OTTO

University of Iowa

Put a foreign language teacher in the same room with some videodisc equipment and invariably visions of projects involving motion pictures with dual-language sound tracks result. While the videodisc's still-image capability is always there among the list of features, not much serious consideration is given to teaching applications using this aspect of the technology. Instead, retrieving still-frame images is dismissed by many as a "glorified slide show." This constitutes a very unfortunate oversight in light of the multiple occasions on which pictures are integrated into foreign language study at every level, from elementary courses through graduate study. Photographs, slides, and filmstrips routinely serve to stimulate conversation and composition, to facilitate vocabulary acquisition, to illustrate geographic and cultural information, and to convey parallels in art and literature. The computer-controlled videodisc represents a stunning advance over other still-image photographic media as they have traditionally existed and have been handled in the educational environment.

First the practical, physical advantages of the medium cannot be denied. An enormous amount of still visual material can be stored on a single minute's worth of a videodisc: 1,800 pictures! The videodisc does not require stacks of boxes and lots of room for storage. Problems of fading, color change, brittleness, and wear and tear due to use are virtually eliminated. Furthermore, the disc allows efficient flexibility in retrieving, organizing and displaying the images. In our own library at the University of Iowa Language Media Center, we have a number of slide packages and filmstrips, each with a very specific subject focus. Most of the pictures in these programs could be drawn upon or reorganized to meet other presentational objectives, but this never occurs. Obviously, filmstrip format doesn't lend itself to any kind of flexibility in this regard. But even in the case of our holdings in slide format, there exists a certain psychological barrier to changing the original organization of a package. Our visual holdings are regarded not as a collection of images--a permutable entity--but rather as a collection of sets of images, with each set related to a single, narrow objective. We have a less useful library because of this view. Besides, it is time-consuming and cumbersome to locate and rearrange slides, and discouraging to disassemble old groupings to build new ones from the pictures at hand. With a videodisc backed by a retrieval system, the task of locating and assembling pictures with a specific purpose in mind becomes fast and easy; and the same picture can be present as part of any number of "permanent" groupings.

Having reviewed the advantages of the technology, let's examine how you make it work. Meaningful use of a videodisc containing still frames assumes computer intervention on two levels. At one level the computer functions as a data base management system, that is, a means of storing information about the frames on the disc and of selecting subsets of frames to suit given criteria. The first major concern in dealing with a large visual archive is structuring the system for storage of information about the images and for its retrieval. Preferably, this is accomplished using an existing data base management program on a computer with at least minicomputer capacity--microcomputers are simply not powerful enough to handle large data bases effectively. This first, crucial step determines the shape of the data base: what kind of information about each image is to be stored. After consideration of the probable search strategies which would be used to retrieve the kind of material of interest to us--i.e., pictures to amplify various aspects of foreign language education--the following descriptive fields or classification categories have emerged: "Frame Number," "Time," "Place," "Topic" ("Theme"), "Generic Subject(s)," "Specific Subject(s)."

The first two fields contain very straightforward numeric information. The frame number is, of course, the key to locating the picture on the disc, and the "Time" field relates the subject of the picture to a point in time. The rest of the categories require more depth of description, the vocabulary for which is largely structured or controlled within certain prearranged guidelines. The concept of "vocabulary control" is an important one if the search mechanism is to work properly and efficiently.

"Place" includes a country name and, optionally, one or more other geographic proper names (city, state, region, and the like). These names are used as keywords or descriptors when searching for pictures of specific locations. The "Topic" field is defined on the basis of an arbitrary selection of themes. Some theme keywords or descriptors typical of this category are "Domestic Life," "Community Life," "Festival," "Architecture," "Entertainment," "Costume," "Industry," "Travel," "Landscape," "Art," "Education," "Gastronomy," "Government," "Trades," "Sports," et cetera. It is important to note here that the creation of an index of terms--particularly for this category and the next ("Generic Subjects")--is a dynamic process involving continual improvement of its structure as work progresses.

The last two categories--"Generic Subjects" and "Specific Subjects"--describe actual elements within the image. In general, the generic descriptors will be common nouns and the specific descriptors will be proper nouns.

Once all of this is in place, selections of pictures are made by giving the information management system instructions to find all the entries meeting one or more specified search conditions. For example, one might request the system to find all pictures of the North Sea region or of twentieth century buildings in Bavaria. Users would not typically come into contact with the data base program, but rather would be prompted via an intermediary program to make selections to specify search conditions through a series of menus and queries. They would also be able to visually review the results of the search and edit (remove from or add to) the pool of items.

The second level of computer intervention for videodisc use focuses on delivering the pictures selected by searches conducted on the data base. This function is carried out through a framework of computer programs which handles creation and presentation of visually enhanced computer-based lessons and for controlling the presentation of visual instructional materials. A microcomputer is an appropriate and convenient device for this aspect, though not necessary, given the presence of a larger computer.

The prospect of our computer-catalogued, computer-controlled videodisc with a collection of 3,000 pictures of people, places, and things in German-speaking countries provides an interesting context for a variety of visually prompted activities. In the classroom the teacher controls the image display. It is the ideal tool for illustrated lectures and a natural as the centerpiece for civilization courses. It offers an excellent medium for directed conversation based on a picture or series of pictures. The same applies to stimulation of extemporaneous speaking. There is also the prospect of vocabulary building without the intervention of English. The major advantages gained by using the videodisc are that selection of material is accomplished efficiently and from a much larger archive of materials than one would otherwise consider or have access to, and that on-the-spot flexibility of displaying the images results in a smoother presentation, particularly if there is reason for flashing back to previous frames or skipping around to summarize or emphasize a point.

In an individualized computer-based learning situation, the videodisc adds a dimension which encourages different activities than those typically seen in CAI before. Among the possibilities here are question/response drills based on visual materials. For instance, preposition drills could easily be formulated based on subjects' relative location to each other in the picture. In the same vein, visually-prompted vocabulary drills are a natural application--how much better a picture prompt than an English equivalent! In a type of reading comprehension exercise, captions would have to be matched to pictures. Of course, there could be illustrated tutorials on aspects of culture, art and literature, and the like. With the disc, computer simulations of trips through museums become possible. An individual could be assigned a picture to study carefully; the theme of the picture would serve as the basis for a composition. With further technical advances--for instance, reasonably-priced graphic and text overlay and compressed audio for still frames--the possibilities expand and become much more exciting.

In its role as a still-image retrieval device, the videodisc has real value and appeal as a powerful and encompassing "pure" resource. Not only is the potential user audience larger than that of most foreign language videodisc programs that have been developed, but the materials do not come packaged or confined within a single philosophy of instructional design. As a final note, I would encourage you to do one thing: if you are planning to master a videodisc with a 27-minute film on it, don't waste those last minutes. Fill them with still frames.

USING RESEARCH-BASED PRINCIPLES TO DESIGN STUDENT-CONTROLLED INTERACTIVE VIDEODISCS: DO THE OLD RULES STILL APPLY?

LARRIE GALE

David O. McKay Institute
Brigham Young University

Introduction

The following criteria have been abridged from research in communication, cross-cultural training, visual literacy, learning psychology and other behavioral science disciplines. The application of the principles or conditions of learning implied by these criteria has consistently improved training results in a variety of circumstances and there is reason to believe that they can help the effectiveness of interactive instruction.

The checklist is necessarily synoptic in nature as it is intended to be a tool used by those familiar with learning research. The list assumes its users have a background in psychology or related behavioral science disciplines, and that they are acquainted with the works of Gagne, Briggs, Merrill, Fleming, and Levie. (A selected, annotated bibliography follows the checklist.) The checklist further assumes that its users can discriminate between the major learning outcome types (namely the acquisition of concrete concepts, defined concepts, abstract concepts, rules, problem-solving skills, attitudes).

For further information regarding the meaning or use of this checklist, please feel free to contact:

Larrie E. Gale, Assistant Director
David O. McKay Institute, 121 KMB
Brigham Young University
Provo, Utah 84602
(801) 378-7082

The Checklist

I. General Concerns

A. Is instruction the solution? (Or is the performance problem related to something other than training/knowledge?)

B. Are these materials, is this approach the best solution?

C. Is the instructional strategy proposed/used defensible for the learning type or types?

D. Is the content (skills, attitudes, knowledge) worth teaching--is it defensible?

E. Is the system exportable--can it be replicated elsewhere with a similar audience? (Are the particulars of the system, its use, administration, logistics, evaluation, etc., specifically communicated in detail? Is it sensitive to the needs of different situations, such as government-political constraints, sociocultural constraints, technological constraints, environmental constraints?)

F. Does the system include management procedures for decision making? (Including diagnosing the prescribing instruction, managing the system, keeping track of student progress, the logistics of its resources, facilities, et cetera?)

G. Does the system include record-keeping procedures that make it accountable in terms of student performance and practical functioning of the system as a whole? (Formative evaluation and summative evaluation should exist with formative evaluation being different in that more data will be collected to help in the design of the system and summative evaluation being primarily of student progress which will probably be simpler and less detailed.)

H. Does the system include valid diagnostic/prescriptive measures?

I. Does the system include appropriate motivational strategies?

II. Content/Message/Evaluation Concerns

A. Do the instructional materials capture and hold attention?

B. Do the instructional materials help learners to selectively attend to the desired information/message?

C. Are cues, schema, visuals, and so forth used to help the learner's storage, search, and retrieval strategies?

D. Does the instruction unwittingly introduce interference that negatively influences learning or memory?

E. Do the materials/media use appropriate and effective techniques that encourage practice in the use of sought-for cognitive strategies?

F. Is the content organized systematically, logically?

G. Is the organization of the content apparent to the receiver?

H. Are advanced organizers used or needed?

I. Is repetition appropriately used?

J. How are the pieces of content (facts, labels, concepts) related to each other? Does the organization of content (or of the learning experience) show these relationships and thereby promote retention?

K. Does the content have systematic, hierarchical structure?

  1. Are the objectives and performance made clear to the learner?

  2. Does it have a clearly specified sequence of instruction?

  3. Do the objectives match the content?

  4. Is the content integrated through regular, systematic reviews?

  5. Does the evaluation match the objectives and the content?

  6. Do the examples match the content, objectives, and practice?

L. Are appropriate examples provided in terms of their level of difficulty, ability to demonstrate critical attributes and not cause misperceptions, overgeneralization, or undergeneralization?

M. Is there ample opportunity at appropriate segments for student response and practice?

N. Is there ample, appropriate, timely (prompt), specific feedback that's tied to the content, examples, and objectives?

O. Are other forms of reinforcement in evidence and appropriately used?

P. Is repetition built in and appropriate, obvious, understandable, and not tiring?

Q. Is there a general overview of procedures, resources needed, "how to do," et cetera? (Watch out for vague directions like "Discuss the problem now" or "Research this need."

R. Do the materials provide guidance and helps?

S. Is there a strong contiguity between presentation/examples and practice/feedback? (Contiguity means they all should be close, immediate.)

T. In concrete concept learning, are the distinctive features (critical attributes) obvious or communicated clearly?

(Strategies: 1. use "matching" exercises; 2. use "contrast practice"; 3. magnify or exaggerate differences; 4. learn single discriminations first, then mix up their order and review them--you should also learn new discriminations while old ones are reviewed; 5. the critical attributes that you are teaching should be tied to the learner's past experiences; 6. exaggerate differences at first, then gradually reduce the exaggerations to normal representations.

Problems: 1. the more the critical attributes, the more difficulty in using them to discriminate; 2. the more similar critical attributes are to noncritical properties, the greater the problems of overgeneralization or misperception; 3. if critical attributes are not tied to the learner's past experience or are unknown from the past, then discriminating differences between critical and noncritical attributes will be difficult or impossible until appropriate experience is provided.)

U. To show that someone has learned a concrete concept, do they respond in terms of a common abstract quality? (In other words, is the performance impossible based on simpler forms of learning. You should use novel, unencountered instances for testing this.)

V. If verbal instruction is used for concrete concepts, are there accompanying practice opportunities with real-world objects?

W. In concept learning, are there several contiguous examples?

X. In learning defined concepts or rules, are there definitions provided (or is the learner helped to discover the definitions) when communicating the defined concepts?

Y. In rule learning, these elements need to exist; do they?

1. What performance is expected of the learner?
2. Verbal instructions describing/demonstrating component concepts?
3. A presentation of the rule?
4. Provision of examples?
5. Opportunities for practice?
6. Ample, appropriate, prompt feedback/reinforcement?
7. The learner demonstrating that he has "acquired" the rule?
8. Include integrated review, spaced over time, which will enhance retention?

Z. In problem solving, are the learners informed about what it is they are to achieve--are they informed about what constitutes "solving" the problem and what their goal is?

AA. If instructions and directions are provided in problem solving, do they encourage and permit the student to discover the rule for himself? (They should! Directions shouldn't detail the steps to the solution because the rule will not be learned.)

BB. In problem solving, do the instructions/cues (verbal or written) stimulate recall of relevant rules and describe the general form of the solution? (Providing more than this may prevent "discovery" and the student's "seeing" the rule.)

III. Verbal Learning Concerns

(This is not a learning type/training outcome but a delivery strategy, and as such runs across all learning types. However, because most instruction is delivered verbally, this section was seen to be essential to any instructional design considerations.)

A. Has requisite knowledge (facts, labels, concepts) been acquired earlier and is it available/remembered?

B. Does the training (or materials) take advantage of the fact that new verbal information is learned by being incorporated into existing, large networks of previously acquired contexts?

   1. Is the information made meaningful through association with already learned labels, facts, et cetera?

   2. Is the information made meaningful by clustering it into previously acquired categories?

   3. Is the information made meaningful by incorporating it in propositions?

   4. Is the information provided in contexts related to past knowledge?

   5. Are advanced organizers used to provide structure and context?

   6. Is repetition used? (Very helpful.)

   7. Is overt rehearsal, actual recitation or other overt, repeated response required and tied to reviews?

   8. Are integrated reviews used? (Restatements or repeated practice, carefully and systematically woven into the instructional system.)

   9. Can the verbal information be tied to or stimulate mental images?

C. Does the new verbal information include distinctive cues to make it memorable--more readily retrievable?

D. Does new verbal content include information and practice that show or encourage transfer to unencountered situations?

IV. Learner Concerns

A. Does the content have meaning for the audience; is it "meaningful" or tied to past experiences and understanding? (A must for verbal learning!)

B. Does the system provide for student control of learning and learning resources?

   1. Control of when the student studies?

   2. Use of the materials/system virtually anywhere?

3. Control of the pace (rate) of presentation? (Can the student control the pace, back up, repeat, et cetera?)

4. Control of the level of difficulty?

5. Control of information flow through more than one sensory modality (eyes, ears, smell, touch)?

C. Are the learners' expectancies (own goals) known and does the instruction take them into account?

D. Are the vocabulary, visuals, cues, etc., appropriate--based on the learner's culture, language abilities, experience, and understanding?

E. In learning concrete concepts, does the learner have the prerequisite skills or knowledge for the specific task? (Usually this is an ability or abilities in discrimination and acquisition of earlier labels or verbal skills.)

F. In learning defined concepts, do the learners "have" the prerequisite concepts? (This includes relational concepts and thing concepts. Are the prerequisite concepts easily accessible/retrievable to the learner?)

G. In problem solving, do students have the required cognitive strategies, rules, and experiences to recall and apply to the problem? (Strategies include search, differentiation, fluency of hypotheses, and matching instances to a general class. See Gagne, *Conditions of Learning*, page 162.)

V. Attitude Acquisition/Change

A. In attitude acquisition or change, does the receiver possess the requisite knowledge, skills or intellectual abilities that will assist him/her in being successful or feel positive about the desired object?

B. In attitude acquisition, is the context of the experience pleasant, enjoyable, and/or rewarding. Does it engender or elicit positive emotion?

C. In attitude acquisition, are accomplishment, reward, success (as feedback or results of experience) highly probable? (This is a must!)

D. In attitude acquisition/change and the use of human models, is the model respected or admired? (most important!)

E. In attitude change, is imitation of the human model by the learner sought or encouraged?

F. Is modeling used to encourage attitude acquisition?

    1. Is the model appealing and credible?

    2. Can the learner remember the object of the attitude and see situations where the attitude applies?

    3. Does the model clearly demonstrate/communicate the desired choice of personal action?

    4. Is the model's appropriate choice clearly reinforced by pleasant, positive consequences?

    5. Do the model's inappropriate choices obviously result in negative, unpleasant consequences?

G. Are sources seen to be highly credible by the receiver? (Expert, trustworthy, et cetera.)

H. Is the source perceived as similar to the receiver? ("He's like us.")

    1. Is he perceived as ideologically similar?

    2. Is he perceived as familiar?

    3. Is he liked?

(See Section 4, "Persuasion," in Fleming and Levie's *Instructional Message Design.*)

VI. Cross-Cultural Communication Concerns

In addition to the above general instructional design concerns, there is a series of concerns that could potentially cause problems for instructional systems or instructional materials intended for use by semi-literate or illiterate audiences, or audiences from different cultures. These concerns are added to the checklist from direct personal experience, from studies and position papers.

A. What is the nature of the concepts to be acquired? Are they based on other concepts? Do they match the conceptual reasoning abilities or experience of the target group? (Concepts causing problems may include conservation of mass, conservation of shape, conservation of numbers, quantities, the notion of straightness, the concept of time, concepts dealing with space like verticality and horizontality.)

B. Depending on the way the content is provided, can there be confusion stemming from the fact that illiterates may define one thing as several distinct things existing at the same time?

C. Are cause-and-effect relationships clear? (Especially if they are not tied to visual, concrete, apparent likenesses.)

D. Do the materials and instructional system take into account the "here and now" thinking reality of the villager?

E. Do the materials and system take into account the villagers' concrete thinking style (this being tied to real objects)?

F. Is too much (or too obtuse) abstraction assumed or required? (Shouldn't be.)

G. Was the idea that "language may limit conceptual ability/experience" considered as the materials were developed?

H. Were the mental photographic imagery capabilities of the villagers used to good effect? (Villagers typically have photographic memories, vivid imagery.)

I. Is there a heavy reliance on abstract alternatives instead of concrete, here and now choices? (Shouldn't be.)

J. Is the notion of egocentricity taken into account? (Villagers are generally unaware of others' viewpoints.)

K. Does the message go from the concrete and known to the unfamiliar?

L. Do the materials, the instructional system, require (or assume) one-way communication of content by an "expert"? (They shouldn't.)

M. Did the system's design and resulting materials consider the language, expressions, colloquialisms of the culture?

N. Does the system consume more resources than necessary to produce the desired result?

O. Is the instructional system or are the materials, more precise than needed?

P. Do the materials require illiterates to retain information, visual images, etc., to remember or use them later in the materials without their obvious existence? (Shouldn't.)

Q. Do the materials require abstraction from previously-introduced materials, visuals, et cetera? (Shouldn't.)

R. Do the materials provide for, encourage, or require stimulation of villagers' experiences to offset any lack of experience that they may have? (This can help them acquire visual literacy skills, concepts, et cetera.)

S. Do the materials assume that the content is communicated through visuals just because the visuals are there? (They shouldn't. We learn how to "read" pictures. Perception is based on experience.)

T. What is the role of the background stimuli in the visuals? Do they interfere, distract from the main message?

U. Do the central messages in the visuals compete for attention with background details?

V. Are internal perception factors considered in designing the visuals? (Like expectations, motivation, interests, habits, attitudes, et cetera.)

W. Are eye movement patterns considered in visual design?

X. Are eye fixation zones considered in visual design? (This is especially necessary in posters or visuals with more than one element, message, or subpart.)

Y. Are details with high valence used appropriately? (Does valence of elements attract and help communicate, or distract?)

Z. Are movement cues in the visuals appropriate and understandable for the experience base of the intended audience?

AA. Are passage-of-time cues in visuals appropriate and understandable for the experience of the audience?

BB. Which depth cues are used in the visuals and are the cues clear? (Do they communicate?)

1. Shade cue (lines, cross hatch, stippling, tone, contrast)?
2. Scale cue (relative size)?
3. Converging lines cue?
4. Superimposition cue?

CC. Are identity cues readily apparent and decipherable to the audience?

DD. Do the perspectives used in the visuals (angle of view) communicate or confuse?

EE. Is the perspective subjective for demonstrating skills?

FF. Are the dimensions of objects clear in the visuals?

GG. Are the visuals artistic more than functional? (Shouldn't be.)

HH. If line drawings are used, are they drawn from concrete experience familiar to the audience? (Line drawings are probably too abstract.)

II. Are visuals simple in terms of the number of messages, number of details, and how they are executed (style)?

JJ. Do visuals and materials expect the student to abstract from them in time, location, or space? (They shouldn't.)

KK. Do visualizations or dramatized messages (in visual form) come from the target tradition and culture?

LL. Are some visuals multi-frame like a comic strip? Do they suppose the sequence that should be followed? (The sequence won't be followed.)

MM. If cause-and-effect is pictured in the visual, is the relationship clear?

NN. Are visuals assumed to be self-explanatory? (Shouldn't be.)

OO. In motion-vision materials, do the film-making conventions (CU, ES, LS, flashback, dissolve, fade, etc.) confuse?

PP. Is animation used? (Doubtful positive effects.)

QQ. Are cutaways, exploded views, cross section used? (Technical illustration will prove confusing without explanations and interpretive help.)

RR. How is color used? Does it conflict with cultural uses and values?

SS. Is color coding used? Does the culture have distinct vocabulary terms for each color used?

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The listed references were selected as support to the checklist and represent the major or more influential works from the field. Much of the applicable research has been abridged or translated into the principles found in the starred (*) works.

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A compendium of behavioral science research, this book describes those principles that research suggests will improve the communication of instructional messages. Designed to be a handbook, it describes the nature of research conducted and lists the conclusions as numbered, boldfaced entries that are easy to access. The book is organized into perception principles, memory principles, concept learning principles, and attitude change principles.

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This conceptual paper is based on the practical experience and preliminary research of Andreas Fuglesang, whose years of development experience were primarily in Africa.

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PRESENTATION AND DISCUSSION OF THE INTERACTIVE PROGRAM MONTEVIDISCO

JUNIUS BENNION

Brigham Young University

ABSTRACT

Session Content

The combination of two new technologies, the videodisc and the microcomputer, have made possible the simulation of interactive dialogue. Using new interactive scripting techniques we have designed a simulated visit to the hypothetical Mexican city MONTEVIDISCO. With partial FIPSE funding we have produced a set of videodiscs and an interactive delivery system that allows the student to visit MONTEVIDISCO and talk to some Spanish-speaking inhabitants.

Students begin by typing their names and indicating their sex: sex identification is necessary because of the gender differences in the Spanish language. For males the camera pans to the town square. A man who is leaning against a lightpost takes notice and walks toward the camera. He greets the student by asking, ¿Es usted un turista norteamericano, verdad? (You're an American tourist, aren't you?") The computer causes the videodisc to freeze-frame and then puts up a set of choices (in English) on an adjacent screen. The student inputs the number of one of the choices, translates it and speaks it in Spanish. The computer coupled with a voice-actuated circuit records the spoken production on a cassette for later critique by an instructor. If desired, the student can see and hear a surrogate student speak his choice on the TV screen. Then the computer directs the videodisc player to search for the next scripted scene which is designed to lead to a new set of response choices. In this way the videodisc generates half of the dialogue and the student generates the other half.

The choices may lead to getting tickets and going to a bull fight, getting a taxi, haggling over prices at the open food market, going to the restaurant, cantina, or bar, extracting oneself from the hospital or police station. The videodiscs for females operate in a similar manner, but the experiences are different, and of course the surrogate is female.

The branching sequences will provide motivation for repeated use of the videodisc. The conversational style is light and entertaining, and for advanced students the environment is a labyrinth video game. For less-advanced students the use of an ever-present choice, "What did you say?" and the repeat capability for the surrogate student allows repeated exposure to each sequence as determined by the student. Because of the interactive nature of our system, only one student should operate the system. Small groups could benefit from it, but would have to "vote" on each set

of choices, and of course, the cassette recording would not be very helpful.

We believe that highly interactive videodisc programs that are also entertaining have the best chance of success, and that these new technologies will greatly enhance the quality and appeal of language instruction programs of the future. Because we have designed our programs to be easily used for other new productions, the creation of interactive videodiscs in other languages will be less costly. Interest in this type of instruction ought to lead to the formation of educational consortia that will be able to economically design, produce, and distribute large quantities of copies of each disc once the initial hardware investment has been made.

We will be trying out this system in advanced Spanish conversation classes this year at BYU and hope to obtain evaluation data to verify our expectations of student acceptance and achievement.

"KLAVIER IM HAUS"-AN ANNOTATED VERSION

PAUL LUCKAU

Brigham Young University

In contrast to the free-form programming system of preparing an interactive instructional opportunity, I use the same template authoring system set up to program the first film annotation which was completed about two years ago at Brigham Young University: "Macario," an 87-minute Mexican film. The template system allowed me to annotate the 12-minute video episode "Klavier im Haus" quite rapidly. The only delay was in obtaining permission from GETN (German Educational Television Network) to make a limited number of copies of "Klavier im Haus" for specialized experimental non-profit purposes. I am, however, cautiously optimistic about getting permission from the many sources of film and video episodes to annotate, and the many episodes, vignettes and dramas available for instruction.

"Klavier im Haus" is different from "Macario." "Klavier im Haus" is intended to be the first short vignette in a series of three depicting life in a modern setting (in full color) in a German apartment house for a TV audience. "Macario," adapted from a novel, has more to offer in terms of literary analysis.

I divided the video episode into 18 scenes. In preparing questions I thought would be important to students, I concentrated on language analysis--mostly vocabulary and expressions--and culture exploration as well as aspects showing feelings, gestures, moods, and significant movements of the people in the film. I used a one-half-inch VHS video cassette to prepare the annotation, and for that reason tended to keep the format somewhat linear. We had interesting success in branching even with the video cassette. The videodisc will allow much faster access to the scenes via the microcomputer, as you will see.

It was easy to divide the video episode into 18 scenes. It was difficult in some scenes to have much oral interaction to annotate. In these scenes, I concentrated on facial expressions and significant kinesics.

Incidentally, the more I see the film, the more possibilities I see for interactive instruction and the more refinements I would like to experiment with. We are in the process of allowing the students to use the program and to react to the program. We are keeping track of the questions they choose and the ones they don't choose. We are experimenting with "self-check" tests or class tests to see if they take advantage of all the annotations. I am examining very carefully the difference between program control and student control or, possibly, a mixture of the two. I plan to include experimentation with an interacting audio cassette recorder/player.

The English version of questions and annotations is available for specialized use--after attempts at solving the problems and a good deal of inferencing using the target language--for those students whose learning styles demand it, but the use of English is controlled for pedagogical purposes.

As a teacher of German, I am interested in affording my students as many opportunities as possible to immerse themselves in an environment where they can hear German and interact in German on the cutting edge--the learning edge--the challenging edge! However, I want to avoid overwhelming them. I trust that language acquisition can take place when the student is interacting with the language in the larger context of experiencing the language especially through listening (as well as through reading).

I am aware of the role of television in the lives of students, the spell it can cast on them, and its potential for constructive as well as destructive education. Similarly I am aware of the same effects of computers--especially computer games. I have faith that the use proposed here of interactive experience of the student with television and computer will be very constructive as well as very appealing. In the process of learning, contiguity is very important. The information and experience are close and immediate. The student doesn't have to search; he/she has control over the computer which gets the information immediately.

So often I've shown films in class even with a planned introduction and followed by a planned discussion only to note that the class is somewhat entertained and only temporarily involved. In the case of individualized (or small group) interactive involvement with video and computer followed by preparation and discussion in a small group, I noticed that class discussion and input retention are enhanced. More experimentation should confirm this experience. Some of that experimentation is in progress now.

There has been considerable discussion about the so-called exorbitant costs of programs interfacing the videodisc and the microcomputer. The use of the template authoring system, the preparation of the videodisc, and the preparation of the annotation have cost about $5300.00 for "Klavier im Haus." The use of the template approach makes the annotation of existing materials (video episodes) less expensive than the free-form system of programming.

How the System Works

I. The Video Screen. The computer will call up the video episode "Klavier im Haus" and will allow it to play on the video screen until interrupted by the student controlling the computer. The student knows that when the action changes, a new scene begins, and he or she can stop the action (the picture "freezes" on the video screen) by pressing the space bar.

II. The Computer Screen. When the student presses the space bar and the action freezes on the video screen, the basic options and a series of questions relating to the scene being viewed appear on the computer screen. The student can now explore any of the questions and obtain a text response on the computer screen. When finished with the questions, he can use one of the control options to continue or review the same scene, or to review a previous scene. If he or she happens to call up the next scene when the video action is interrupted (space bar), and the previous scene is wanted, it can be obtained by immediately employing the control options to go back.

III. Approaches. Possibilities for individualization of instruction, for grouping of students for instruction, or for using the system in the classroom are left to the participants' imagination. We are experimenting with all three approaches at the present time.

IV. Computer Files. Samples of the computer-generated files that would appear on the computer screen are listed below (and attached). (I assume the reader has seen "Klavier im Haus" and will not need samples of what would appear on the video screen.)

A. Basic instructions.

B. Menu for scene 8.

C. Sample script for episode dialog of the scene, first third.

D. Sample script for episode dialog of the scene, second third.

E. Sample script for episode dialog of the scene, third third.

F. Sample language analysis.

G. Sample culture exploration.

H. Sample culture exploration continued.

A. Basic Instructions

"KLAVIER IM HAUS"

An Interactive Language Program
Using a Videodisc and a Computer

Introduction

Welcome to the wonderful world of German daily apartment house living brought to you by means of videodisc and computer (two screens).

Content

"Klavier im Haus" is a slice of life in a video episode lasting only 12 minutes. There are 18 scenes, each of which has an average of two to three language analysis opportunities and two to four culture exploration possibilities stored in the computer.

Procedure

1. See the entire episode to enjoy the whole experience.
2. Notice that the action changes and people come and go quite often. Each of these changes involving action or people or both is a scene change. Each scene lasts about a minute or less--one or two a little more than a minute.
3. Press the space bar to stop the action (videodisc screen) as often as you have questions and would like to interact with the computer. If you find the episode and the culture easy and quite apparent, and you feel confident you do not need much help, you might want to spot-check only to see what is available. You could stop every minute or two.
4. After pressing the space bar, you will see (on the computer screen) various opportunities and questions. By means of the first six options you can control the presentation. By the questions you can analyze the language or explore the culture or both. Take care of the language analysis first because as you choose an option, other possibilities are then seen among the language analysis opportunities. All of the culture options are available every time.

   To choose an option, press the number key for that option and then press the return key. If you do not press the return key, nothing will happen. The answers appear on the computer screen. The computer will then direct you to press the return key to return to the menu.

B. Menu for Scene 8.

zene Nummer 8 - Klavier im Haus

BEI HERRN KRUSE (AN DER TÜR)

---

1. Weiter zur nächsten Szene!	4. Programm beenden!
2. Zurück zur vorigen Szene!	5. Diese Szene wiederholen?
3. Betriebsartinformation	6. auf englisch!

---

7. Was ist das erste Drittel des Textes?
8. Was ist das zweite Drittel des Textes?
9. Was ist das dritte Drittel des Textes?
0. Welche Wörter und Ausdrücke braucht man, alles in dieser Szene zu verstehen?
1. Welche anderen Wörter und Ausdrücke braucht man, alles in dieser Szene zu verstehen?
2. Haben Sie das kleine Zimmer beim Eingang in Herrn Kruses Wohnung gesehen?
3. Haben Sie das kleine Zimmer beim Eingang in Herrn Kruses Wohnung gesehen? (continued)
4. Haben die Bewegungen und Gesten eine bestimmte Bedeutung?
5. Klingt die Beschreibung unheilvoll und sehr unangenehm?
6. Scheint Herr Kurays gelähmter Arm etwas mit seiner Art zu tun zu haben?

. Was ist das erste Drittel des Textes?

Herr Kruse: Also, von mir aus spielen Sie ruhig. Ich habe Musik ganz gerne. Ich war früher mal selbst in einem Spielmannszug+. Habe aber nur die Trommel+ bedient, also keine große Sache. Musiker bin ich wohl deswegen nicht, aber es war eine schöne Zeit und ich habe seit dem was für Musiker übrig+. Wie gesagt, ich freue mich, daß wir wieder einen Musiker im Haus haben. Aber es gibt einen im Haus, der sich nicht freut, bestimmt nicht freut.

+marching band
+drum
+have a fondness

(cont'd. on Option 8)

8. Was ist das zweite Drittel des Textes?

Frau Klinger:	Herr Kuray, nicht?	
Herr Kruse:	Man hat Sie schon gewarnt?	
Frau Klinger:	Ja.	
Herr Kruse:	Ein fürchtlicher+ Mensch. Verschlossen,+ mißtrauisch,+ unfreundlich. Niemand im Haus, mit dem er Kontakt hat. Wenn der nun ein Kind laut weinen hört, dann geht er hoch+.	+dreadful +withdrawn +distrustful +gets angry

(continued on Option 9)

15.

Was ist das dritte Drittel des Textes?

Herr Kruse:	Also, da sehe ich ernsthafte Schwierigkeiten. Wissen, Sie, der Mann hat einen wie soll ich sagen, einen toten Arm. Hat mal einen Unfall+ gehabt. Vielleicht kommt alles daher, daß der Mann so unverträglich+ ist.	+accident +unsociable
Frau Klinger:	Ich meine, vielleicht kann mein Mann spielen, wenn er nicht im Haus ist.	
Herr Kruse:	Der ist ja pensioniert, der ist immer zu Haus. Bei gutem Wetter geht er spazieren, aber höchstens eine Stunde.	

10. Welche Wörter und Ausdrücke braucht man, alles in diese Szene zu verstehen?

(What words and expressions will one need to get the full value of this scene?)

Spielmannszug - (marching band)

die Trommel - (drum)
    Ich habe nur die Trommel bedient (conversational past)
    I just played the drum.

übrig-haben - (have a fondness or have something left over)
    Ich habe etwas für Musiker übrig.
    I have a fondness for musicians.

12. Haben Sie das kleine Zimmer beim Eingang in Herrn Kruses Wohnung gesehen?

Wenn die Türen in der Wohnung geschlossen sind, bildet sich ein kleines Zimmer beim Eingang, die Diele. Hier lassen sich sehr gut Mäntel und Hüte und Regenschirme aufbewahren und vor allem bewahrt die Diele die private Sphäre der Wohnung. Man kann die Welt wahrhaftig besser fernhalten. Auch gelangt wahrscheinlich weniger Lärm vom Korridor in die Wohnung. Beachten Sie wieder das Telefon (an der Wohnungstür), durch das man mit Leuten außerhalb des Wohnhauses sprechen kann.

(cont'd. on Option 13)

13. Haben Sie das kleine Zimmer beim Eingang in Herrn Kruses Wohnung gesehen? (cont'd from Option 12)

Zum Schutz des Privatlebens gibt es die Tür am Haupteingang des Wohnhauses (abgeschlossen), die Sprechanlage, durch die man herausfinden kann, wer zu Besuch kommt, die Wohnungstür (abgeschlossen), und die Zimmertüren in der Wohnung (die abgeschlossen werden können).

MAKING EXISTING VIDEO MATERIAL INTERACTIVE

CAPTAIN MICHAEL BUSH

United States Air Force Academy

ABSTRACT

Efforts of recent years have brought enormous quantities of video and film materials to the education marketplace. In spite of the fact that many of these are quite good, they are all lacking in one essential element--interaction. Indeed, the noted education journalist George Leonard states that the magnitude of American technology makes possible errors of great magnitude. He seems to dismiss "educational" television as one of the more prominent of these errors because of its lack of interaction. However, the advent of the microcomputer with its ability to control video peripherals provides a solution to this problem, thus adding new life and vitality to many materials that already embody good and valid pedagogical principles.

There are, nevertheless, new problems that must be overcome--the least of which not being the lack of resources to implement the necessary systems. Day-to-day needs, requiring the resources of time and money, must be met and the proposed systems make demands on these already limited resources. Other difficulties involve communication problems among system developers such as programmers and subject matter specialists. Finally, even if good systems are developed, will sufficient packaging and marketing approaches be found to convince the potential users of the systems' worth?

There are very plausible solutions to each of these problems, but the best approach is to make the system so intrinsically appealing that objections are forgotten as capabilities are observed. There are basically two areas for effort to accomplish this objective: hardware and software, just like any other computer-related problem!

Hardware considerations involve decisions related to choosing systems that meet user requirements in a friendly, cost-effective manner. In particular, there are certainly times when videodisc is necessary, but others when one-half-inch videotape is sufficient.

Strategies for the development of interaction are the problems to be solved that are of a software nature. It is obvious that questioning is necessary, but what forms should student answers take: multiple-choice, fill-in-the-blank, or whole sentences? It is also necessary to decide at what level the interaction is to take place. Questions can be asked on content (grammatical, cultural, or dramatic) or can engage the student in problem solving dialogues. The latter seems to be a particularly fruitful area for investigation since man is born as a problem solver.

SPION: "INTELLIGENT" GAMES FOR GERMAN LANGUAGE TEACHING

RUTH H. SANDERS
Miami University

SPION ("Spy") is the first game of a computer game system we are currently designing and implementing for learners of German. It combines machine understanding of natural language (in this case, German) with the capacity to recognize grammar errors. We have chosen games both because they are a good teaching tool and because they are a convenience vehicle for studying natural-language interaction between humans and computers. We began work on this project in fall of 1981 and as of this writing anticipate having a working prototype model of SPION by October 15, 1982.

A computer game seems a good teaching tool because of the inherent motivation it provides: it is fun to play a game, and losing it encourages further play in an attempt to win. A computer also offers instant feedback, generally recognized as important in foreign language learning. SPION immediately either does as it has been commanded or it tells the user an error has been made. The game will not proceed until the player's German is correct.

As a research vehicle, a computer game offers an acceptably "natural" limitation on discourse. The player communicates with SPION in only two types of sentences: the command and the question. Within these two types much flexibility is possible, permitting study of how understanding of language occurs; but concentrating on limited areas of language allows us to stake out a manageable territory within the huge field of language. Our lexicon has been initially limited to the items that are named, and the actions that are possible, within the world of our game. At the same time, the game structure seems ideal for incremental development of sophistication.

Our overall research effort may be viewed as a process of, first, creating a simple game, then a simple language model adequate to this game. As we add sophistication to the game, we will revise the language model as necessary. As we design new games, we will use the existing language model as a base for building more sophisticated language models as well.

SPION is somewhat similar to ADVENTURE and other computer word games now on the commercial market. The machine plays the role of agent. The user must, through commands and questions to the agent, discover the correct path for getting from the airport in West Berlin to town, finding and interpreting clues in the environment necessary to obtaining secret information, going to East Berlin, meeting another agent there, trading the information for other secret information, returning to West Berlin, and leaving the new information with a contact. Doing this successfully means winning the game; there are many paths for success, and many for failure. Communication between the user and the agent is always in conversational, correct German (unlike ADVENTURE, for example, which uses an abbreviated two-word code). Error messages are sent to the user in cases of grammar error or impossible commands.

The game begins with the agent in Tegel Airport, West Berlin. In his pocket he has 100 marks, an authentic-looking passport from an unspecified Western country, a visa for one visit to East Berlin, and a piece of paper with a telephone number and a notation to leave information with Max. In the airport he sees a cafe and a sign pointing to the bus to town. He can go back to the airplane (and get a ride to Antarctica), to the cafe (which is closed), or for a walk (large heath all around, to the east another bus stop). If he is told by the player to telephone Max now, or at any time before he has met the other agent in East Berlin and gotten the information, there will be no answer. If he is told to take the bus to town, he gets off on Kurfürstendamm in front of the Hotel Kempinski and near a bookstore and a chocolate shop, both of which will contain further clues.

The player must lead the agent step-by-step through the maze, with the computer keeping track of where the agent is and what he has with him; he may spend money (thus subtracting from the 100 marks), pick up notes, buy things, and use his visa.

To make the prototype work, we have designed a "lexicon" (along with a facility for adding to and revising lexicon entries) and a "parser." The player's command or question is tested against the model of grammatical structure in the parser as well as against the syntactic constraints of each word as listed in the lexicon. If the player's input fails to "measure up" to the computer models at any stage, an error message appears on the screen. If the input is lexically and grammatically correct, it is sent on to the "semantic interpreter" to be checked for appropriateness (i.e., does it make general sense) and to the "game program" to be checked for appropriateness in the game world (i.e., can it be done at that moment). To determine the appropriateness of a command, the game program consults its data base for the "game specification," which contains the overall rules and structure of the game being played. If the input passes here, it causes an appropriate change in the game state (in the case of a question, no change at all), which is then recorded as the new status quo. A verbal response is made if necessary (in the case of a question). The semantic interpreter, the game program, and the game specification are now being debugged. When they are operational, the prototype model of SPION will be ready to be played. We are now working on programs for inputting static semantics and for specifying games. These elements will make it possible to design other (more sophisticated) games using this system.

Our language-processing mechanism consists of a phrase structure grammar with three components: context-free, context-sensitive, and semantic. The last two are handled together via attributes, predicates and action symbols (a formalism known as an attribute grammar).

In our prototype grammar, only two types of sentences will be recognized and accepted: the command and the question. We have therefore designed a very basic grammar that deals only with these two types of sentences. The context-free component of the grammar looks like this:

```
SENTENCE →IMPER   QUEST ;
IMPER   →verb  pronoun  OBJECTS  ADV  PP "!" ;
OBJECTS  →OBJ  OBJ ;
OBJ → ART  ADJSEQ  NOUNSEQ| nil ;
ADV → adv| nil ;
PP  →preposition  OBJ ;
ART  →defart| indart| genart| nil ;
```

et cetera.

In this grammar notation, the words in capitals denote concepts that are defined within the grammar itself; words in lower cases are not defined further here, but are categories from the lexicon. Thus, a SENTENCE is defined as an IMPERative or a QUESTion; an IMPERative is a verb, a pronoun (which must always be *Sie* here) and OBJECTS, an ADVerb, Prepositional Phrases and an exclamation point (mandatory in German). OBJECTS may consist of two OBJects (the indirect and the direct), each of which consists of an ARTicle, and ADJectiveSEQuence and a NOUNSEQuence, or nothing at all. An ADVerb may be an adverb from the lexicon, or nothing at all. A Prepositional Phrase consists of a preposition and an OBJect. An ARTicle is a definite article, an indefinite article, a general article, or nothing at all.

Of course, imperatives and questions in German may take other forms than those defined here, but our grammar at this time specifies only the kinds of sentences which are "legal" in the prototype SPION.

The computer has, then, a fairly complete command of the rules of grammar for a very small domain of discourse. It does not use this knowledge to generate correct sentences in German, but rather for two other purposes: 1. to respond to the player by printing out a pre-written description of its game state or by changing the game state as requested; 2. to recognize and comment on incorrect language usage or inappropriate commands from the player. Here too, it will not generate comments, but rather select an appropriate comment from its memory. These are the initial specifics of a planned larger facility to enable the user to ask questions about the state of the game. The computer keeps its inventory up to date by "understanding" the meaning of taking, leaving, buying, et cetera. Of course, language understanding involves numerous inferences based on previous knowledge. Clearly, this is the most difficult part of the project.

The context-free component presents the bare bones of the basic structures possible in SPION. It enables the computer to recognize the words it reads in the player's commands and questions. But it does not differentiate between sentences with the same grammar structure. Differentiation comes from further detailing of the grammar with attributes and their manipulation. For example:

$$\text{IMPER}_t \rightarrow \text{verb}_v \quad \text{pronoun}_p \left\{ \text{pronoun} = \text{"}\underline{\text{Sie}}\text{"} \right\}_{*}^{p} \ \ldots$$

Here the bracketed instruction requires a check that the pronoun Sie, the only pronoun acceptable here, is present. The asterisk subscripted outside the bracket means that the computer will print an error message to the player if Sie is not present.

Other attribute manipulations in the grammar read OBJects and differentiate direct from indirect objects, then check that these objects are in the proper case, and that any articles and adjectives that modify them show the proper gender, case, number and "strength."

The grammar instructs the computer to build a "parse tree" (indicated by the subscripted "t" on IMPER) for the sentence, which it can then begin to interpret semantically according to instructions. For example, for each verb we have specified its qualities and how its use modifies the state of the game. For each type of misuse we have specified an error message. For lesen ("read"), for example:

lesen must have direct object. Else → error message ("Was soll ich lesen?"--What shall I read?);

and

object must be either in agent's possession or in same location as agent, else → error message ("Das ist nicht möglich."--That's not possible.);

and

object must be literature, else → error message ("Das kann niemand tun!"--Nobody can do that!);

and

object must contain message, else → error ("Das hilft nicht."--That doesn't help.);

result: print message of object;

Our lexicon consists of approximately 130 entries (80 distinct words), subdivided into the parts of speech. Each form of a word (i.e., plurals, case forms) is a separate entry. Properties of each word are described in its lexicon entry, so that all possible forms can be found. For example, the lexicon for lassen ("leave"):

lassen, V (A, D, D);

It specifies the part of speech (V=verb), whether a direct object is possible (A=yes, in accusative case), whether an indirect object is possible (D=yes, in dative case), and the case governed by a two-way preposition used with this verb (D=dative).

An example of an entry for a noun is provided by Zettel ("slip of paper"):

Zettel, N (M : N A D ; PL : N G A) ;

It specifies the part of speech (N=noun), its gender (M=masculine), and the possible cases this form may show (N A D = nominative, accusative, dative; PL : N G A = plural nominative, genitive, accusative).

Thus, the program scans its lexicon entry for each word it encounters in the player's discourse, and checks whether these forms may legitimately appear in the sentence according to its grammar. If no, it sends an error message (e.g., it tells the player to check the dictionary; or if the message is very garbled, says it doesn't understand; or if it is impossible, that it can't be done). If the sentence can be parsed, the program responds by changing the game state as requested or answering the question.

The error messages are limited in scope and are not very analytical: they tell the student that something is wrong without being very specific about what it is. This is done intentionally for several reasons. The experience of one of us (Ruth Sanders) in teaching language suggests that, especially in the very simple discourse used in this game, telling students exactly what is wrong for every error is no more helpful than simply telling them it is wrong. If they have mixed genders, numbers and cases, they are more likely to benefit from the use of a dictionary than from a detailed analysis of every error. They may learn more and remember more, if they don't get too much help from the computer. A final, and perhaps the most important, reason is that we want SPION to be experienced primarily as a game rather than as a language exercise. Too much discussion of grammar, we felt, could make SPION into a drill. As planned, SPION is to offer the fascination of a computer word game along with the opportunity for repeated practice in accurate usage of a small repertoire of structures and vocabulary.

In order for the system to be useful for foreign language instruction, the hardware requirements must be kept at a minimum. Programs which deal with significant subsets of natural language are notorious for consuming large amounts of computational resources (computer time and memory space). Therefore, a major consideration will be using microcomputers as a network. That is, if 10 students are using the system on 10 different machines, each should have the computing power of 10 machines rather than one. A separate, independent research project will be the major source for software addressing this problem.

For the prototype model we are using a 64K Z80 system (CP/M) with two eight-inch, single-density floppy disks. The implementation language is PL1. Ultimately the language used will be BAFL, which was designed at and is now being implemented at Wright State University.

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COMPRESSED AUDIO AND SECOND GENERATION VIDEODISC SYSTEMS

STAN JARVIS

Electronic Information Services

I had a call Saturday to be a pinch hitter, to talk about what technology is doing. I first considered a bewildering display that's never been done in public: five totally different videodisc formats lined up in a row across the table, all of them operating. Each one has its own benefits. You've only seen one today, the laser reflective disc. But my wife said I couldn't take her bus, so I drove my old VW bug. As I started loading the car, I ran out of space for formats. So I decided to forget the RCA. You can see an RCA videodisc player anywhere. It's the world's most popular format, and is obliterating the optical disc in the consumer market. I thought about bringing up a Thomson, but decided it'd be better to throw in a Jacquard towel. The Jacquard weaving mechanism was the first use of punched cards. Before Jacquard's invention, one weaver and five assistants could only weave a half a yard of cloth a day. Jacquard, a young French weaver, came up with the idea of using a punched card to control the weft of the cloth. One weaver with no assistants could produce a yard-and-a-half of cloth a day. The French in their infinite wisdom said that technology would destroy their weaving industry, and forced him out across the English Channel whereupon the English saw a good thing coming. Within 70 years the English dominated world commerce. They dominated the world textile market, and set up a colonial empire to provide raw material to their little Jacquard looms. The French have an interesting history of having rejected the best of technology which set the rest of the world on fire. Today, with modern technology, the French are working harder than anybody else to avoid a repeat of past history. Well, suffice it to say the CHP has a limit as to how high you can stack boxes in your back seat, so I only brought two videodisc formats. I wanted to show you different formats because they're available, and each one offers its own advantages.

I've worked full time in videodisc development since 1978. I was one of the original employees at WICAT, involved in early videodisc program development, from their first educational disc to early computer-controlled discs for the Army. I did economic analyses for the Army, assessing decisions to field videodisc technology worldwide. Returning to manufacturing, I was senior project manager at one of the videodisc development facilities. I've been involved in data storage applications and DRAW applications. With a recession going, it seemed an excellent time to start my own company, and that's Electronic Information Services.

Now I don't know much about you, so let me ask a few questions. We'll make this interactive. First, how many of you are working in the public sector? (Okay, a clear majority of you.) Now how many of you are from the U.S., Canada, Japan, or the Fiji Islands? (Okay, majority again.) That means I can eliminate stuff about videodisc applications in Europe. Now, how many of you have used interactive videodisc systems one way or the other? (Better than a third here.) How many of you have access to videodisc systems within your employment institution? (Almost the same number.) The killer question--and this is the one I love giving because I rarely see hands--how many of you own or have videodisc equipment in your home that you personally paid for? (Good grief! I have seen groups of 500 with fewer hands; three is very unusual.)

The videodisc is one of the technologies that everybody lusts after, but wants the other person to pay for. Videodisc, like so many technologies before, has been touted as the ultimate solution to educational problems. It's not. It's an extremely expensive solution. I'd like to show you a few vu-graphs. If there's any organization in them, it's purely by accident.

The way to understand videodiscs is to look at them in parallel with audio discs and videotape. I'm currently writing a four-part article for a videodisc magazine, *Videodisc News*, on the history of videodiscs, starting back 100 years. The key things to look at are back in the 1880's. Let's start with audio discs.

In 1884, Alexander Graham Bell was involved in optical disc recording using 12-inch discs. He recorded sound in both AM modulation and FM modulation. Those optical discs still exist today. They were last played in 1960. Bell came up with a ton of patents, including one on how to record on wax. He licensed that to Edison, who made the phonograph a few years later. Edison introduced a complex cylinder, tough to manufacture, but it did the job. Then the Germans came along and invented the flat disc using the same 12-inch that had already been established by Bell. A disc was a lower-cost media, easy to manufacture; it annihilated the wax cylinder market. About 15 years thereafter, the British post office introduced optical audio discs for recording time messages. If you called them, you would hear, "It is 3:40. God save the Queen." The post office used those until about 1962. Optical recording has been around for a long time.

I am convinced that the founder and genesis of videodiscs was in Germany. People blame John Logie Baird for being the inventor of the videodisc. That's not true. He developed the Phonovision system with a Televisor, a mechanical scanning television system. They broadcast television signals over the normal BBC radio; it was so complex that it took about a half hour to get the system adjusted and tuned. Baird placed test signals on a little disc which you could play on a phonograph to help owners warm the television up, so that when that half-hour-a-day program came by, one could actually use it. He said that his inspiration came from German patents of the 1880's. So we come back to Germany again.

Now, videotape. Just before World War II, the Germans invented magnetic audio recordings. Two key prizes that the American invaders saved from Germany at the end of the war were the Volkswagen plant and as much German magnetic recording equipment as they could find. That was taken over by AMPEX and developed thoroughly. And in 1956 AMPEX developed the quadruplex videotape recorder.

Stereo records were developed at the same time. All these developments came into an interesting confluence which resulted in different groups of people conceiving modern videodisc technology in 1958. Look at the companies that are in videodiscs now, such as 3M with 22 years in videodisc development. They are finally selling videodiscs for 20 bucks apiece. IBM showed optical discs in the 1964 World's Fair with language translation, for Russian-to-English translation dictionaries. RCA began in 1964. RCA is the world's leading authority on optical disc development, and they're producing, of course, non-optical vidoediscs. General Electric was also involved early on.

I get excited about history. If I had gone into teaching, that's what I would have taught. Today, there are many technology survivors out there. The 45-rpm record was a real dud, but it still exists, as do 33 1/3 records. Incidentally, the reason for the odd number is that the original talking movies used an audio disc for the soundtrack, and the disc standard was set years ago at 12". By running the record at 33 1/3, the length of the audio on the disc matched the length of a can of film. The audio cassette and the new digital audio disc are coming out. In videotape, there is two-inch quad and one-inch types B and C. Three-quarter-inch and one-half-inch formats are popular as they're less expensive than the broadcast videotape formats. Last, there are one-quarter-inch formats including the Funai-developed system now being sold by Technicolor and Grundig. A few months ago, Sony, Matsushita, Hitachi, Grundig, and Philips all agreed to use the same one-quarter-inch standard. You will see by 1985 a one-quarter-inch cassette the size of an audio cassette containing two hours of video with three channels of audio, two of which are on high-quality subcarrier and the third on a parallel track. You won't see it before 1985 as they are only starting to make money on one-half-inch videotape. With investment cycles, they're trying to put one-quarter-inch off as long as they can. But you'll get down to pocket-size video recorders soon. Videodisc technologies include laser vision, VHD, CED--with almost 400,000 players sold, and McDonnell-Douglas.

There is a lot of mystique ascribed to videodisc technology, yet there is no mystery. Consider the similarity between videodisc players and tape machines. Each has some kind of a transducer to pick up signals recorded on media, then send the signals to audio and video amplifiers. Each also has some kind of controller. That controller may be a button or even an external computer.

An interactive system with a videodisc may be only a player with output devices. Output devices include televisions and sound speakers. Input devices can be buttons, keypads, touch screens, anything like that. That's all a videodisc system is, but the key thing to note is that the user is interacting with the input and output devices. As far as the disc player is concerned, the user is not nearly as enamored with it as the manufacturer of the machine is. It's just another peripheral.

Information on videodiscs is recorded in either pits or prints. A laservision disc starts with clear plastic. The information is recorded inside in a series of pits. Then comes a coating of aluminum, then glue, another aluminum layer, and the reverse side in plastic. It takes a very complex manufacturing process to make a disc. Somebody earlier mentioned an article that noted disc cost--my name was at the bottom of that article--86 cents per disc. But just so that you know, the "by the way" is ("by the ways" are the details that are never printed until after you've paid for the stuff) that it takes an $8.6 million investment to make discs, and it only reaches an 86-cent-cost at full capacity, manufacturing three million discs per year. The total volume for the optical disc market is under a million discs per year.

CED is the RCA disc with the needle in the groove. The information is contained in pits exactly the same as laserdiscs. Laserdiscs are recorded in real time, spinning at 1800 rpm. Since CED discs are mastered on aluminum, which is a super heat sink, it only records at 225 rpm. Starting with a blank disc of aluminum, CED first cuts the grooves with an ordinary lathe. In the bottom of the groove, they put a series of laser-burned pits. VHD information is also in pits. On VHD discs, there are no grooves. The stylus slides all over like an optical disc. It has an extremely complex mastering process.

The other alternative is prints, like photographic negatives. That's like what Alexander Graham Bell did in 1883. Incidentally, Bell's disc used a solar-powered recorder. Before smog hit Washington, D.C., you could actually record information with a solar unit. It wouldn't work here in Monterey. There are some variations to that process. Anybody ever see a Teldec videodisc? This was a German invention. Among those in the videodisc engineering community Teldec was highly respected. It provided 8- to 12-minute programs on a single slide and was mechanically read. No pits. In 1972, the year that Teldec was publicly introduced in the Berlin International Exposition, Philips shows their first VLP videodisc player with its 30-minute capacity and stereo sound. The machine Philips showed blew Teldec out of the market. GM and others are using discs. But just because videodisc is available does not necessarily mean that it's going to dominate the market.

Here are the various sizes of videotape, from two-inch, one-inch, three-quarter-inch, one-half-inch; there's even a one-quarter-inch cassette in there. As the media become smaller, it also becomes less expensive. The old expectations of videodiscs being cheaper than videotape just don't hold. You can put two hours of programming in your pocket with videotape. If you try to put a disc in your briefcase you may crack it. New camera/recorders are coming that are about the size of a dictionary--two inches thick by eight inches by 11 inches. Manufacturers are just waiting for the proper time to bring them out.

Training is typically the application one sees with a videodisc system. A videodisc player is essentially a peripheral to the computer.

The Thomson videodisc technology was developed by CSF Corporation, which merged with Thomson early in the 1970's to become Thomson-CSF. Thomson already had DRAW programs aimed primarily at the broadcast industry; therefore, the read-only system received little funding and internal support. The only company that gave Thomson any serious consideration was Zenith, who looked at it very seriously, but abandoned the technology in 1976. The technology has essentially been dead since then, but they didn't formalize its demise until just a few months ago.

The reason videodiscs look so colorful is because, whether pits or prints, the information lengths are about equal to the wavelengths of light. That's a photographic videodisc player. A little spot of light can be seen coming from a light bulb, normally used to illuminate high technology flashlights. The laser is just a source of light. A photo diode reads the disc. And you could replace the laser with a proper light source in a Sony player and read it back. I wouldn't recommend doing it though.

The Army dilemma is: how to train a less-competent learner to do a more complex task in a shorter period of time at a lower cost. If the Army is going to use videodisc technology, it must be justified on its economic aspects much more so than on effectiveness aspects. All expectations were that a computer-assisted video learning environment should be effective. Testing so far indicates that is the case. Back to economics. Essentially the Army is considering replacing dirt-cheap audiovisual devices like the $500 Beseler Cue/See with a $5,000 system.

I authored a study for ACTO in January 1979, on the economics of videodisc technology for distributed training. We found that consumer videodisc systems were not cost-effective for the military and should not be fielded. Industrial videodisc players were even more costly. Consumer players cost about $600, the industrial models about $2,000. The surprising fact we discovered, based on economics alone, is that if you add more costs for a compressed-audio and microcomputer-control, the technology can become cost-effective. Incidentally, this finding was based on costs provided in 1978 of $400 a side for mastering and $1 per disc-replication-cost! Now, no matter what you put down for costs, it's going to be obsolete within a few months because prices keep changing. But the military is looking at more than just training. There are a lot of other applications for the same device as well. I did an Army demonstration videodisc on one side of a single side with six 40-minute audiovisual lessons, 50 million practice items, two million tests, and a built-in author training course on the same side of the disc. You can pack a lot of junk onto a videodisc. The Army's love and dream is a briefcase videodisc player, with flat-panel television, voice in/voice out, et cetera. A lot of work is going into such devices for maintenance. Maintenance is a major challenge. If you can teach a technician basic skills and give him a machine that provides decision tree diagnostics with audio-visuals, the economic savings can be immense.

Ford Motor Company now uses a Sony videodisc system, but the cost benefit of videodisc over videotape at their numbers was modest. The first videodiscs for Ford, incidentally, were done in 1971. And again, I don't speak German so I wasn't involved in that.

Let's review technology that is available today. Incidentally, you can put about 10,000 pages on the videodisc and read it back, but not with a normal TV monitor. You've seen the Sony videodisc and the Pioneer; they're compatible, yet incompatible. They're incompatible so that you won't switch to the other company's equipment. "How much does it cost to do a videodisc program?" I have developed them for $30,000 to $750,000 with the same amount of material and same amount of instructional effectiveness. What's the difference? One used all-union labor and professional facilities in Los Angeles. I like the cheaper disc better. As an example, let's look at a disc that cost a quarter of a million dollars per side to produce. You can see what the difference is. By using broadcast equipment and highly-paid crews, the costs go up. Now that level of expense is justifiable when you're selling to the consumer market. In the consumer market, you may compete against NBC, CBS, and Lucas Films. When you go against the pros, you've got to play the ball game the way they play the ball game. The example shown is of one of the two things people feel will be the salvation of the optical disc--visual music. The other is X-rated films. (One X, not three X's). In the manufacturing process videodiscs are played back totally by a group of women several times.

The example is called "Takanaka's World" from Japan. The Japanese have very high demands for quality. It tours all around the world with music. Very artistic. They hauled a planeload of equipment around the world to produce it. You don't need this in the classroom. Nobody need spend a quarter of a million dollars per side for a videodisc. Now for a low cost example, a $1.63 animation sequence. That's the cost for a pack of yellow paper and three colored pens. The key thing about it is that you don't have to spend tons of money. You can get by well on far less if you don't get involved in the expensive parts of technology.

This is a capacitance player. It costs $500, loads up front, has stereo sound, and is programmable. Its disc will play on any machine of this format anywhere in the world. I can take this NTSC disc to Europe and it will play on a PAL player and a PAL monitor, as well as SECAM. As far as international transportability, in my estimation that's the best consumer player I've yet seen. There are other alternatives such as the photographic, McDonnell-Douglas videodisc. Industry training managers noted the problems with videodisc technology are that it's expensive, it takes a long time to get a disc made, and you can't make discs in one's own company. Well, we could put a McDonnell-Douglas recorder in this room and make a videodisc. If you've ever developed black-and-white film, then you know exactly how a master disc is processed and the level of technology needed to do it. On the film master videodisc are recorded little rectangles of different gray-scale colors. There's a duplicator. To make a videodisc master for the reflective technology or for the capacitance technology, you consume about $300-$350 worth of material for which the manufacturers charge $2,000. For a photographic videodisc master you consume about $6 in film and $3 in processing chemicals. If you want to do your own videodisc recording, it's interesting. You could use a three-quarter-inch, even a one-half-inch VCR to record from. Optical videodisc recorders cost a million dollars or more. Those (photographic) recorders could be coming out for $200,000 or less. If you already have videotape equipment--three-quarter-inch, one-inch, whatever--you have the most expensive part of what you need for doing videodisc recording. Their players will be the same price as the Sony. It also does something else the others do not do: compressed audio. When a videodisc training system needs lots of audio, still-frame audio is desired. A laser disc has a half hour of sound. The capacitance discs have one hour. There are systems with external audio, to augment the disc itself. There are other systems with internal or on-board still-frame audio, with up to 30 seconds of audio per still image. There are also systems that operate without a videodisc. Let's go on to another one here; still-frame audio is being developed by Philips, Sony, Panasonic, McDonnell-Douglas, and Electronic Information Services. Philips puts the audio on the same frame as the video. It is intended for consumer-type applications, adds about $300-$700 per player. Sony has demonstrated an 8-second per frame system in a PCM system. You lead in with a motion series. Pioneer is showing their system for the first time. It's a similar system. McDonnell-Douglas uses a light bulb to simultaneously illuminate 10 tracks. In the diode are 10 heads, to read 10 tracks in parallel. It can pick up audio off any of the tracks or video as well. My company has a system that we've developed with 17 seconds per frame. It's fully concatenated in both audio and video. As you branch from one end to the other you do not lose video. Audio is continuous. Even in music you can branch the disc back and forth, and the sound never stops.

If you're interested in recording, there are sources. Why get involved in recording? Surprisingly, the organizations that are most interested in being able to control their own recording are the military and educational institutions. General Motors has no interest even though they're the largest consumer of videodiscs in the world. They buy their tires outside; why should they put a videodisc plant in? A real reason why people are interested in recording is for the process of creating interactive instruction on videodisc. You plan, you set your objectives, you prepare, and then the expensive part, produce. Then you press it and wait. My longest wait has been nine months; my shortest has been two weeks. It is a 20-minute wait with photographic technology. When you finally receive it, you program it, and then...apologize. Time after time I hear people apologize for errors they discovered after the fact. When you do err while writing a book, you correct it. When you err when creating a computer program, you correct it.

When you err with videotape, you correct it. At least you have the ability to correct it. But all you have with a videodisc is the ability to apologize, because once you finally get it, there's no change. But with the ability to record, if you can do it for a few dollars, it's like "never having to say I'm sorry."

The last thing I'd like to show is an alternative to videodisc. This is a device called CAI-TV by Tesco, the leader in Englsih language training in Japan. CAI-TV is for computer-assisted instruction for children, and it's very effective. Information is stored in standard audio cassettes. They didn't want keyboards for children, so they used the ubiquitous lightpen. It has a 192x256 eight-color RGB display. One channel of the cassette provides sound, and the other image and control data. It is a Z80-based machine with 96K RAM and 48K ROM. In ROM, it has the full ASCII character set, Katakana character set and it also has the full Katakana and Hirigana character sets. Arabic and Kanji come on the cassette tape. I took the CAI-TV home to my kids, and even the five-year-old tried those Japanese programs and was listening to them with no problem at all. It's an interesting little device, especially at less than $1,000.

In summation, there are many technological alternatives. Each has its own benefits and problems and will impact you economically.

SOME TRIVIAL WAYS OF USING A MICROCOMPUTER IN LANGUAGE TEACHING

HANNO MARTIN

Goethe Institute, York

Mathematical logic was, in the year before the Second World War, a highly esoteric subject. In German-speaking countries, though the first quarter of the century had seen such eminent logicians as Frege, Hilbert and Gentzen, and, amongst the following generation, Carnap and Goedel, the flowering was brutally cut short by the Nazi regime, which was violently anti-intellectual and anti-formalist. When I was a student, there was not a single textbook of mathematical logic in print in Germany.

This has dramatically changed all over the civilized world. The present boom in mathematical logic and the theory of algorithms is, of course, intimately linked to the advent of the digital computer.

A major link has been the theory of formal languages, construed to act as a medium of communication between man and the computer, though it was hoped that at least one such language, ALGOL, would serve as a means of communication between scientists themselves.

The advent of cheap and even personal computing has brought about a flood of popular literature on some of these languages.

It is safe to say that, in recent years, for each textbook on German or English as a foreign language, there were at least a dozen or so on BASIC, and more recently on PASCAL. The reason for this is probably not only intellectual curiosity, but career thinking: it is much easier to find a job nowadays on one's knowledge of FORTRAN or PASCAL than of French or German.

This is not the place to dwell on the obvious differences between natural and artificial languages. And it is certainly not our purpose to discourage the learning of natural languages other than our own, but I think one must point out the growing competition the teaching of French or German is subjected to by the formal languages used to communicate with computers.

It is difficult, too, to blind oneself to a lot of common features, not only between natural and formal languages, but also between the learning processes involved, as has been perceptively pointed out for instance by the American psychologist R. J. Anderson (*Cognitive Psychology*, 81). Specifically, the emergence of fluency in manipulating the language in larger and larger chunks is a strikingly similar process.

On the other hand, it is a well-known endeavor of at least one section of the computer science community to develop formal languages into something approximating more and more closely the languages we normally use. The evolution from machine code over assembler languages and FORTRAN, etc., to PASCAL is a telling example. Of course the resolving of ambiguity and vagueness are very resistent problems. But to make the computer a truly domesticated machine, either we will all have to learn LISP or ADA or the computer will have to learn English and Japanese and Russian.

Once this has happened, there will be little competition for the teaching of foreign languages from computer science. Instead we would have to only learn how to discipline our thought. Meanwhile it is perhaps a good policy to look for some common ground in the teaching of formal and natural languages.

Basically the formal analysis of a sentence in a natural language is the same kind of procedure as the analysis of a statement in a computer language by a translator, only much more complex; both procedures are named after an age-old term of traditional grammar; parsing. A parser is a necessary subprogram of any compiler, and the very name (quae pars orationis) betrays its origin from Latin grammar.

Amongst the many features which distinguish natural from artificial languages are formal irregularities; thus in Arabic the plural of dubb, "bear," is dibaba, whereas the plural of hubb, "love," is hubuub. Grammarians have ever since endeavored to find the underlying system; grammar is largely precisely that: the disclosure of regularities underlying apparent irregularities (probably, science in general is).

Taken this way, grammar is, of course, an ideal training ground for writing computer programs. Besides some basic programming logic and a few string operations, little else is required to program grammar; the main difficulty is the logical sequencing and the organization of the program. Once a satisfactory program of some aspect of grammar is achieved, the sequencing and exact formulation of rules may give extremely useful clues for a teaching presentation. As a rule, a language teacher's presentation of rules is rather messy, and it takes a lot of common sense and luck on the student's behalf to get it to make sense; only rarely is it presented in the simplest and hence most effective way.

It should be quite a challenge for students to try to program certain aspects of grammar; they will have to learn a lot about the language (under their teacher's guidance) and will have to crack some nasty problems of programming logic. The area open to investigation is practically endless, and from a programming point of view probably more exciting than numerical problems, which become interesting only once deeper insights into mathematics have been acquired, which usually happens only at a later stage of education.

This is perhaps not what most people expect when they hear about computers helping to teach a foreign language, or even the mother tongue, but, considering especially the rush into computer education, is, I think, singularly important. Some additional importance may come from the fact that, as natural languages are more and more used in connection with computer systems--to witness the tremendous progress in speech synthesis which gives us talking clocks for as little as $30.00--more purely technical jobs may require a knowledge of the structure of some natural language.

Linguistics can be divided into syntax and semantics. Post-Bloomfieldian linguistics, in particular the so-called structuralists, tried to describe language in purely syntactic terms. Chomsky's approach was, in the earliest years, purely syntax-orientated; the turning point was Katz and Fodor's article in 1964.

The major publication in semantics has been Ullman's book, *The Principles of Semantics* ('51). Ullman's chapter on the history of the subject contains just a dozen or so names. The latest fad at that time had been Korzybski's General Semantics and Zipf's Law. Apart from this, semantics, like linguistics in general, had a rather historical slant.

Even vaguer is Ogden and Richard's classical essay, *The Meaning of Meaning*, published in 1923. The success of this book and its many new editions up to the present day show, however, the growing interest in semantics over the years. Philsophical semantics was above all concerned with establishing truth conditions for well-formed formulae of propositional or predicate calculus. Tarski's definition ('36) that the sentence "it rains" is true if it rains and only then, seems (though it isn't) hardly more than a truism and doesn't help the linguist, who is much more interested in how different bits of meaning interact.

The first real attempt to come to grips with a theory of meaning was possibly a result of the fiasco of the projects on computerized mechanical translation of the early and mid 50's, which were then (Minsky) the only non-numerical projects subsidized, and heavily so, by the U.S. Government (which goes to show, if need be, how naive decision makers often are).

The necessity of a semantic component to translation was pointed out in an article by Bar-Hillel, first published in *Advances in Computers* in 1960, from where the famous example of "the box is in the pen" comes. The first serious attempt at semantic representation came within the framework of what, since Minsky's paper in '61, has come to be called Artificial Intelligence.

There is no time here, and neither am I competent, to go into the brief history of that subject and describe the papers and programs, of Raphael, Quillian, etc., of that time. Some programs, like Weizenbaum's famous ELIZA, were mere hoaxes.

Amongst the next generation of semantically orientated natural language programs, one of the earliest and best known is Winograd's SHRDLU ('72), where the user can communicate with a real or fictitious robot about handling blocks and pyramids of various colors and sizes in a sensible way, and the robot can talk back if a command is foolish, such as, "Put the largest block on the blue pyramid." Though Winograd's "block world" is extremely limited, the program offers a fine example of integration between syntactic and semantic analysis.

A more cavalier approach as far as formal syntax is concerned, and in this rather reminiscent of modern trends in foreign language teaching extolling the communicative aspect and relegating "grammar" to a secondary role, is that of the so-called Conceptual Dependency theory, as practiced at Yale by Shank and his group. A particularly charming outcome of this methodology is James Meeham's program TALE-SPIN which, from certain ingredients chosen by the user, invents all sorts of little fairy-tale-like stories.

This little digression into semantics was only to point out the possibility of including semantic aspects in foreign language teaching programs; the cost is heavy, though, and without severe restrictions the task will be impracticable, if not intractable. With a limited vocabulary, on the other hand, it is a trivial job to make use of selectional restrictions, for instance, so that only drinkable things will be drunk and not shoes and hats. Yet any serious semantic system has to have recourse to a large data base, which means lots of storage and possibly insufficient speed of execution for learning purposes. And though it may be said that the price of memory has recently fallen drastically, and although a compromise on speed could probably be found, one must not forget that the creation of even a moderate semantic data base is a massive job requiring several man-years. Ideally, however, such a data base should be accessible to anyone writing foreign language teaching programs.

Another possible enrichment of language teaching material is, of course, some kind of animated graphics; this would especially hold if they could be linked up with a semantic data base. The student could then really linguistically interact, possible even by voice, with the world on the screen, and provided the picture is three-dimensional, even with a kind of ghost world. The question is, of course, whether this is worth the prgramming effort and hardware support, at least for the time being. In a very reduced form, this kind of multilateral program exists in the form of certain games, especially of the ADVENTURE type. Considering the addiction of many young people to these games, it might appear that they are a very good model for language teaching programs; it is quite possible to refine them in many ways for this purpose.

This is perhaps the point to mention an article by Thomas Malone in the December '81 issue of BYTE, which tries to analyze the various features a game must have to be attractive. Similar considerations might hold for language learning exercises.

Coming to my practical presentation this may appear to be a let-down, particularly after the futuristic vistas just reviewed. First of all it is practical, and technical reasons forced me to take one of my shortest programs because I had to retype it on the last Sunday before I set off for San Francisco (always the same incompatibility problem). Also a longer program would run too slowly if retyped and not compiled, and I had no compiler available on the second machine. In addition I had my doubts even about whether this other type of machine would really be available here and didn't want to waste too many sleepless nights. Having been thus apologetic, I should like to say that even such a short and trivial program can have a few positive aspects:

1. To make the student realize that the apparently bewildering confusion of the German plural formation of nouns can be handled by only four commands, except pathological cases like Atlas/Atlanten, or Floss/Flösse (they are, incidentally, rare enough to be incorporated into the program, as individual data, if one is a patient enough typist).

2. It sets the student, or possibly a group of students, a task which may stretch over a long period: that of building up a library of plurals deviating from the assumed basic rules. Of course, this library has to be validated once in a while, by the teacher or a native speaker, and the computer is thus not taking over completely. Whether this is good or bad is probably a matter of taste.

3. A definite, though perhaps trivial, advantage of this program over an equivalent non-computerized routine is its extreme ease of manipulation; one need hardly be able to write, not to mention type.

Typing is, unfortunately, a skill which is a prerequisite of most less trivial computer exercises for language teaching. Though it may seem regrettable in many ways, it is not unlikely that in the near future typing will largely supersede handwriting, and that, from primary school onwards, writing will become truly digital.

Whether the computer is a useful tool in language teaching or not, is not the decisive question. The crucial thing is the attitude of the teacher and perhaps even more crucial, that of the learner. If one takes into account the eagerness (provided it lasts--but people seem to be hooked up to motorcars for a lifetime) with which youngsters approach computers, the teachers may be fighting a losing battle, within a short time, if their attitude is too much at variance with that of the students.

A USER DESIGN PROGRAM FOR APPLE II

JAMES PUSACK

University of Iowa

I have recently completed work on a foreign language CAI system, which is called DASHER. Many of you have seen DASHER at earlier meetings and already are familiar with the kind of answer-processing strategy I employ there. DASHER picked up an old approach to handling German drill items developed by Adams at SUNY Stony Brook and converted it into a flexible, transportable authoring system which can be used by all kinds of foreign languages. The need or goal from the beginning, I think, was somehow to avoid the trap of committing significant energy, time and materials to a set of lessons which would either become dated quickly, or would not be usable by other teachers. Today I am not primarily concerned with this package itself, or with any other specific program, package, or strategy, but rather with the insights that can be gained for this kind of effort in the future.

There are lots of foreign language teachers out there, more and more each day, who are intuitively certain of the value and potential of CAI. Some of them are ensconced in front of their terminals or their microcomputers chipping away at various instructional goals in BASIC or PILOT, often turning out wonderful learning modules by dint of enormous dedication. Others of them wonder when they will ever know enough about computers or have enough time to really get down to some serious lesson writing so that they can take advantage of available equipment.

My experience over a number of years of reviewing foreign language CAI has made me skeptical about the value of most of the products on the market or in informal circulation. Most of them do not take into account the diversity of goals and approaches which characterizes our field. While I have never reviewed chemistry or math pedagogy, I cannot imagine that there could possibly be, in any other area of basic skills, as much passionate and opinionated divergence in questions of content and methodology as there is in foreign language teaching. We say we "adopt" a given textbook and overlook the irrational implications of this turn of phrase. Show me a department, for example, which is completely satisfied with the elementary textbook it is using. As a result, most CAI packages I have seen will be of great value, for a time, to their original developers, and will prove to be merely incidentally useful to others who "adopt" or acquire them. These packages have not taken into account the realities of the field. At the other end of the scale we find multi-purpose authoring languages like PILOT or COURSEWRITER which offer various tools, but no preset teaching or learning strategy. It is a long row to hoe for any foreign language teacher who wants to develop effective lessons with such a system. In practice, he will soon discover that the available tools must be bent and twisted horribly before they offer the slightest help in foreign language CAI. Tools designed for question-and-answer content tutorials simple do not enable us to develop interactive applications where language skills are meaningfully exercised or developed. In summary, past efforts do not represent models of efficient CAI, either because it was too hard to develop the materials, or because it is too hard to use them, or both.

Assuming that an individual instructor or an institution is willing to devote significant resources to develop foreign language CAI, what design criteria will help us circumvent these pitfalls? First, we need a proven and tested teaching/learning strategy, probably one aimed at a specific subset of foreign language skills. The range of skills, tasks, activities, approaches, and levels is so great in our field that no single CAI program can hope to attack them all, or even those which most naturally lend themselves to CAI. The user or potential "adopter" of foreign language CAI should be able to accept or reject a given package to a large degree on the basis of the teaching/learning strategy employed in it.

Given a pedagogically acceptable strategy, what should we look for in terms of the package itself? What shape should it take so that the product which emerges from our development efforts will appeal to the widest range of language teachers and learners? My cardinal criteria are that it be flexible and adaptable. Let me pin down, now, what these criteria mean for authoring systems like DASHER and what they mean for self-contained instructional packages.

For authoring systems it means that as few assumptions as possible should be made about the level, age, and language background of the student user. If at all possible, the system should be usable in several foreign languages and in ESL instruction as well. Experience shows that most strategies which are effective in German language teaching are transferable at least to the other European languages. The program design should leave as many "features" as possible under the control of the instructor/author. The feedback mechanisms and flow of control should be flexible. Most important, the creation and revision of lesson material should be relatively easy, when compared to the usefulness of the teaching/learning strategy. To some extent, it should be possible to modify the standard routines in order to add new features. In other words, a foreign language authoring system should have all of the flexibility of the best general-purpose authoring systems, while drawing its greatest strength from the very specific approach or strategy it uses. These critera will doubtless only be met by authoring systems which have undergone extensive field testing over a period of years.

I can envision a network of authoring systems which offers a wide spectrum of complementary teaching/learning strategies. Yet this vision may be unrealistic because of the nature and resources of our field. Even at its best, the authoring system approach has one large drawback--each instructor must still become a CAI author, must still expend significant effort at creating materials and entering them into the system, testing them, revising them. What we all really want, of course, is to have the ideal materials dumped in our laps. Unfortunately, when we turn the key on a so-called turn-key system, a grand new "package," we are bound to be disappointed: the examples are not helpful, the terminology is not our own, the vocabulary is not in sequence with our textbook, or the level of difficulty is too low or too high. All these problems are inevitable even if we fully accept the package's particular teaching/learning strategy.

For this reason, I believe that my design criteria for any authoring system can be applied to self-contained CAI packages too. Every distributed package in our field should be viewed by its author as a potential authoring system, rather than a bag of petrified bits. How does this translate into practice? First, the sequence of lessons should be flexible or modifiable. Second, the instructor should be able to edit the actual lesson text--explanations and exercise materials--preferably by using a standard text-editing program, perhaps by using a supplied utility program. Third, various options should be built into the student interaction so that the instructors can determine the best kinds of interaction, especially at the feedback stage of the strategy. As a result, every package will offer itself as a dynamic entity and will encourage modification to suit the needs of various approaches to language teaching. Failure to meet these criteria will imprison us in publishing and distribution practices derived from printed books. We will fail to use the power of the computer to make computer-based materials suit our divergent needs.

It goes without saying that all authoring systems and self-contained instructional packages must have excellent documentation which anticipates the limited computer background of the instructors who "adopt" the program. A significant part of the documentation, however, must go beyond simple description to discuss the teaching/learning strategy. A comprehensive set of recommendations concerning ways to use the program should be offered. Not only must the limitations of the program be underscored; the documentation must also attempt to stimulate creative exploitation of all the program's features. The documentation should not be a message from programmer to programmer, but one from teacher to teacher.

Adherence to these criteria will have some impact on the way foreign language CAI is distributed. Prepublication field testing will have to be expanded. Documentation will need to be rethought. Publishers may need to consider informing users about significant modifications made by specified users, or even offer several versions of the same package. It is also likely that large sets of material developed for a given authoring system will be cycled back to the originating software house for review and possible publication, especially when lessons are developed which support a standard first- or second-year textbook. We should certainly look forward to such a process, which can only serve to make the products of our own efforts available to others and to provide our students with the best possible set of learning tools.

TODAY'S "FUTURE" TECHNOLOGY FOR LANGUAGE STUDY, VOICE RECOGNITION, AND WORD VERIFICATION

BRIAN SCOTT

Scott Instruments

Speech recognition is a process of matching an unknown utterance against a number of known utterances, and selecting the closest match. Although speech technology is still evolving, current technology can be effectively used in many applications. The curse of the technology is its universal appeal. Where can we use the technology? Ultimately, wherever there are machines. The question is, "Where can we use today's technology?"

Speech recognition technology is applicable through the use of a machine that hears, processes, interprets, and executes an audible sound. This machine is known as a recognizer. Inexpensive recognizers (under $1000) are available today. The limitations will continue to require systems designers to carefully select nonconfusable vocabularies and will continue to force users to train the systems to their own voices. Yet speech recognition can work today.

Many speech recognition applications have failed because the system operator had to learn new, more structured and stilted ways of talking to the machine. The attraction of voice is that it allows a natural mode of communication. But that natural, overlearned mode of communication is not easily modifiable. We are all experts at language, and by comparison the machine's need for simple commands and stilted speaking style makes it seem relatively primitive. If we compare the human response to touch screen technology, we begin to have a feel for the problem. When the touch screen does not work, we will try again assuming we did something wrong. We ask what we did wrong. By contrast, we resent a machine telling us that we spoke incorrectly. The point is that we tolerate errors when we have to learn new methods of input. We were probably at fault when there was an error. But we cannot tolerate errors when the machine begins to tread on our own area of expertise, natural language.

How may we combat this basic psychological barrier to the use of speech recognition technology? One way is through better technology. If a recognizer could understand digits perfectly, the way people say them and the way people understand them, then myriads of applications could be realized. The size of the vocabulary is not important. It is the naturalness of the interaction that is critical.

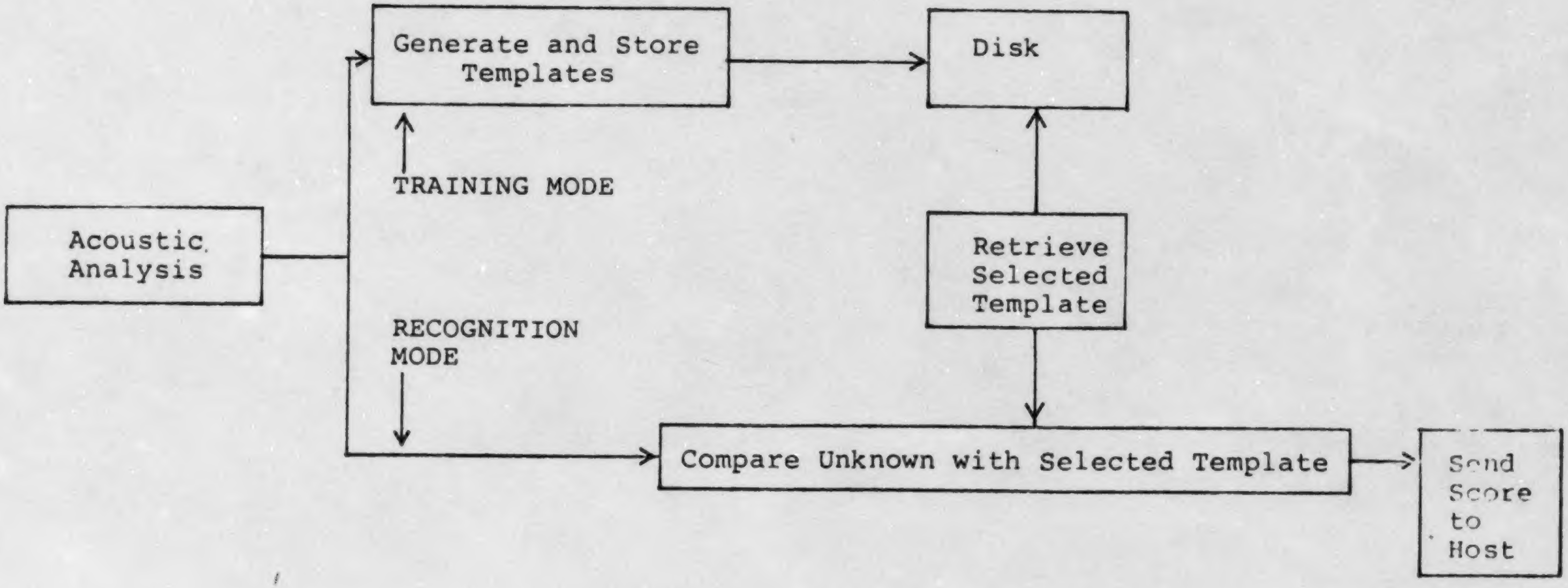
Advances in technology alone will not launch the speech recognition industry. It will require clever systems designers who understand the limitations of voice and can identify applications where the liabilities can be made into assets, and the limitations can be overcome through careful integrated design. The purpose of this article is to identify a class of speech recognition applications where low-cost recognition devices can perform flawlessly and where the value added to the complete system justifies the cost. The technique is called "word verification" (for which a patent has been applied), and the class of applications can be described as being anywhere that the computer is expecting a specific input and must simply verify that the operator is performing correctly.

What are the factors that need to be considered in making the technology work? Of all the factors involved, perhaps the most important for the systems designer is vocabulary size. In fact, vocabulary size is the only factor under the designer's control. The best rule of thumb is that the smaller and less-confusing the vocabulary, the better the system will work. A small vocabulary is easy to train, easy to remember, and less prone to error. A small vocabulary does not necessarily limit the application.

Word verification employs the concept of the one-word vocabulary. The logical limit of active vocabulary constraints is to use one word at a time. That is, regardless of total vocabulary size, only one word or phrase is acceptable at any point in time. If there is only one word active, then the task becomes to verify the active word, not to select the correct word from among several. This is a much simpler task for the recognizer and, therefore, makes the system much more robust. More data can be kept on each word and more processing time devoted to the single word. The vocabulary becomes completely disk-based and the limitations on the total vocabulary size are dictated solely by the mass storage capabilities of the system.

Word verification represents a shift in thinking about how voice can be utilized. As discussed above, most applications have attempted to place the user in control of the computer through speech. The computer must struggle with its limited vocabulary and capabilities to discern what the operator desires. Using word verification, the computer is calling the shots and checks to see if the person understands what is going on by verifying computer selected keywords.

Thus, the technical advantages of word verification are: (1) improved accuracy (the task is simpler), (2) faster response time (only one word to process), and (3) an extended disk-based vocabulary. A word verification system is illustrated on the following page.


Acoustic Analysis
Generate and Store Templates
TRAINING MODE
RECOGNITION MODE
Disk
Retrieve Selected Template
Compare Unknown with Selected Template
Send Score to Host

One application of word verification is illustrated in Scott's VBLS system. The VBLS voice-based learning system is a software/hardware package directed toward educational and training applications. The idea is that the computer is asking the questions and the user is answering them. The VBLS system is actually an authoring system which enables the computer-novice instructor to generate educational courseware. The system is very straightforward and easy to use. Any application where some repetitious learning strategy is required can benefit immeasurably from voice input.

The enrollment, or training, of recognition systems is always considered a problem. In the VBLS system, training becomes part of the learning process. For example, when used to aid the training of foreign languages, the VBLS system can be used in the traditional language lab. The student hears the word or phrase from the tape recorder and, as he would in a traditional foreign language learning environment, repeats the word or phrase audibly. The strength of this system is that voice is integrated into a complete system where the computer demands performance of the user rather than vice versa.

The foreign language study system consists of an Apple II microcomputer, a CRT, a VET voice entry terminal, a recorder for voice output, and the VBLS application software. Individual components of this system can be purchased separately.

The VBLS voice-based learning system recognizes human speech by using an artifical "ear" (Scott Instruments calls it a VET terminal). This electronic device is not nearly as sophisticated as the human ear, but it can recognize the sound patterns of words, phases, and sounds other than speech. The VBLS system can recognize a word or a phrase--in the sense that it has "heard" it before. It does not, however, "know" what the word means. This device must be trained to recognize a specific word or phrase, and to associate a particular meaning to it. For example, the computer tells the student that he will learn certain German idioms through visual instructions shown on the CRT screen. The computer shows the student that the way you say "good bye" in German is Auf Wiedersehen and the disc recorder says, Auf Wiedersehen. The computer then asks the student to repeat the phrase Auf Wiedersehen two times. The computer does this for all idioms of interest. The computer then tests the student's memory by asking, "How do you say 'good bye' in German?" The student says, Auf Wiedersehen, and the computer responds, "Very good" and continues, or tells the student what the correct answer is if the initial response was incorrect. The student may continue to review as many times as he wishes, or the student may choose to practice pronunciation by calling up the word drill practice mode. In this mode the student compares his speech with the instructor's through the use of the bar graph and auditory feedback.

The process of training the system to recognize certain words and phrases is automatic in the VBLS system. It happens as a byproduct of creating a lesson and of a student session. The words and phrases used in a lesson are the system's "vocabulary."

When the author creates a lesson, the correct answers are typed in and input vocally as well. The spoken answers are entered several times to train the artificial ear to recognize a voice. When a student is being tutored and is speaking, the VBLS system is being trained to recognize a specific voice, that of the student. The student only needs to say each word or phrase twice because the system remembers the sound patterns that the author created when the lesson was designed. Once the review begins, the VBLS voice-based learning system has been fully trained in the ways that the student speaks each answer. Therefore, it knows when it hears the student say the correct answer.

The VBLS system allows teachers to author their own lessons. This flexibility encourages individual attention to specific student needs. The VBLS system is designed for those persons not familiar with computer programming, but wanting to take advantage of computer-based learning. The lesson-planning step or the authoring procedure is performed once at the computer by the teacher for each lesson. Basically, the author/teacher types on the computer's keyboard, first entering the question and then the correct answer. The same correct answer is then said into the computer's headset microphone. The system will require the author/teacher to repeat the vocal answer several times, usually five. This repetition teaches the VBLS system the correct pronunciation of the answer. Once the entire series of questions and answers has been entered, the lesson is complete.

The VBLS voice-based learning system was designed to enhance learning in any discipline or level-specific task. The instructional components are organized to function as a tutor or teacher aid. The quality of the instruction, however, is determined by the lesson author, who organizes, designs, and presents VBLS courseware.

Voice-based learning systems involve new methods for organizing instructional materials. The VBLS approach to voice-controlled teaching/learning was developed by the Instructional Design Team at Scott Instruments. Included on this team were a systems analyst, a programmer, a visual artist, and an educational consultant specializing in educational computing. The team was concerned with researching, developing, and testing a voice-based method of teaching/learning appropriate to contemporary education.

The VBLS voice-based learning system focuses the student's attention within an environment that provides an opportunity to learn while speaking. The amount of learning and recall of information that is associated with exercises in pronunciation, exceeds that acquired in a silent environment. Research has shown that pronunciation serves to decode written words into their oral forms and, thereby, elicits recognition (meaning) in response to the displayed word. It has also been repeatedly shown that directing test subjects to pronounce words helps to ensure that the decoding of the word into something meaningful occurs. Speaking while learning enables the VBLS student to turn thoughts into words (as opposed to keyboard manipulations, the traditional CAI method).

Voice-based learning systems, like the VBLS system, are simplifying human-machine communications through human speech, while encouraging visual, verbal, and cognitive skills. The opportunity to pronounce words and phrases is contributing to the process of learning the task at hand.

Speech recognition may as yet be in its infancy, but it is now good enough, and inexpensive enough, that cost-effective applications can and are being found. The secret is in understanding what voice can and cannot do, and in developing user-friendly systems that accentuate the positive aspects of speech recognition.

INTERACTIVE VIDEO FOR FOREIGN LANGUAGE INSTRUCTION: WHY AND HOW

(not presented)

J. OLIN CAMPBELL
and
DAVID M. TUTTLE
Orem, Utah

One of the most interesting examples of the power of interactive video for simulation occurred on a videodisc program designed for the Army Research Institute by WICAT Systems, called "Call for Fire." This videodisc consisted of a series of standard Army lessons transferred to videodisc format, followed by a simulation of adjusting artillery fire. Tryouts showed that soldiers were about as interested in reading lessons on the videodisc as they were in reading them from a book--which means some of them had a hard time staying awake. On the other hand, as soldiers encountered the simulation where they had an opportunity to try their hand at the task, the changes were striking. Interest and involvement went up dramatically. At the end of approximately 12 hours of instruction and simulation, the soldiers could call in artillery fire with a degree of proficiency that rivaled the level expected at the end of a 100-hour classroom course.

For more than 20 years, computer-assisted instruction (CAI) systems have presented textual and limited graphic presentations that have opened the door to interactive feedback with a user. The interactions typically consist of a series of multiple choice or fill-in-the-blank questions with feedback and branching dependent upon the user's response. In a few cases these problems have been generated by the computer (e.g., math problems in drill and practice curricula). In a very few instances the program is actually a simulation using line drawings or words.

Foreign Language Instruction

Interactive video is a breakthrough because it enables and indeed encourages simulations that provide experience doing something rather than learning about it. This distinction is often made as the difference between procedural knowledge (knowing how) and declarative knowledge (knowing what). In foreign language instruction it is like the difference between conjugating verbs and taking part in a realistic scenario using the new language. Whereas the basic message of print has been that language is for analysis, the message of interactive video is that language is for interaction.

Traditional texts, workbooks, slide/tape, and CAI usually are limited to showing what is to be done. Because the computer allows interactions, it can be used for guided drill and practice (e.g., for conjugations and written translations) and for simulations (e.g., for entering sentences like "The man opens the door," and having stick figures act them out). However, the cost of high-quality computer graphics hardware and development has limited the use of

CAI for simulations in the past.

Now interactive video provides thousands of high-quality images, and sounds, any one of which can be rapidly accessed. It provides contexts through visual displays and sound, including cueing, prompting, and confirming responses during interactions. Moreover, we have found that in some circumstances where a team must work together, students prefer to learn in small groups with the interactive video system, and their performance increases as well. This approach is very amenable to foreign language training.

The instructional delivery system can facilitate discourse through a type of visual display accessible to both members of a student team simultaneously or selectively to either of the two. Auditory cues, prompts, and confirmation are available to both, to one, or to the other. This capability enables students to communicate with each other in the foreign language from the onset of instruction.

Interpersonal games can be employed for simulating any appropriate aspect of foreign environment and behavior. "Solitaire" games can be used for practice when no partner is present. Elements of skills, chance, suspense, and humor, added to authentic settings taken from the target culture, make the games stimulating and fun to play. The game format provides practice in a variety of roles under varied conditions and with different players. When ready for a "test," the student gets together with the teacher (or another student while the teacher observes) and goes to a restaurant, makes a purchase, places a call, or any of many "realistic" language activities.

The training of receptive skills lends itself to interactive video. For example, a student can travel to a Mexican village, seeing the sights and hearing the sounds, and be enticed to "interact" with that milieu by asking for the word to match an object, querying the computer for background information, or even "talking" to persons on the street. The BYU MONTEVIDISCO project is an example of these kinds of interactions.

Another kind of interaction is represented by the medical diagnosis type of videodisc where the student can query the "patient" and, depending on the verbal or written responses, make decisions that lead to such outcomes as the patient improving, or a message stating, "Medical team advises against this treatment." The point of this application is simply that language learning can take place in rich and varied settings under real or realistic conditions of interaction. Further, these simulations can be prepared for any of the technical or strategic foreign language competencies required today--from interrogation to greetings, from espionage to public relations, from research to purchases in the market, or from battle commands to setting a table.

As another example, the picture-matching strategy of Winitz, Reeds, Nord, and others is a simple yet effective method for learning and remembering vocabulary that is well-handled by interactive video. Imagine a screen divided into six frames with stick figures in various positions in relation to a book on the table. The audio (or written) cue starts in the foreign language: "The boy is picking up the book on the table." The student touches the illustration described by the cue, using a touch sensitive screen. Finer and finer distinctions are possible with this technique until the student is discriminating such subtleties as "The boy in the striped shirt, with the watch on his left wrist...is pointing at the book." The possibilities are limited only by the author's imagination.

Observations

The door to low-cost acquisition of "how-to" procedural knowledge is open. The effect of interactive video on education and training can already be felt in the initial projects that are appearing. In this initial stage, a few simple suggestions may help to dramatically increase the satisfaction of clients and the effectiveness of the programs. These are observations based on developing and using a series of successful CAI and interactive video programs.

> It is usually better to let the user learn how as well as what. For example, foreign language students can be confronted with a real-life situation via videodisc and asked to respond; history students can play "what if" with Civil War battles to motivate learning facts and factors in major events. Electronics technicians can troubleshoot circuits instead of merely learning major types and tracing them. Physicians can see examples of the symptoms of rare diseases and try diagnosing them rather than merely seeing examples in a text.
>
> Large-scale commercial interactive video production is an expensive team effort. The academic model of one or two skilled authors/scientists/programmers developing an entire program worked with very talented individuals and a low volume of production. However, a commercial production system requires a producer, subject matter expert, author, video director/technician, and software support.
>
> The volume of work to be done in an interactive video production is surprisingly high. Design factors like number and type of stills, consistency of format, and software requirements are a high multiplier of amount of work and therefore cost. An authoring capability can significantly increase productivity, not only because it speeds software coding, but also because it tends to force a clear and consistent style on authors. The limits imposed by the authoring system can usually be overcome, for a price, by hand-coding special sections. In this case the cost of the exceptions is made explicit, so rational trade-offs can be made.

Interactive Video Background

Interactive video is a process in which the user performs a task using a computer-controlled video display that simulates a system like the society of a town or an electric circuit. Presenting text via videodisc or permitting the user to select from a menu of several motion or still sequences to view is not interactive video by this definition. On the other hand, video arcade games and computer-generated image (CGI) systems in flight simulators would qualify.

The term "interactive video" is used rather than "interactive videodisc" because computer-generated images or high-quality random access visuals from sources other than videodisc can be used. The quality of CGI is increasing rapidly, while its cost is decreasing.

Thus the source of the video image (computer-generated, videodisc, video-card, etc.) is not so important as its functional characteristics. In some cases it is better to use a simple line drawing to highlight the critical aspects of an action or entity than to use a full color, very detailed representation. Moreover, computer-generated graphics are almost infinitely variable, while videodisc images are not.

While picture-quality video is usually preferred for some equipment simulations, many simulations involving rapidly changing views can be done very effectively using simple line drawings available on current computer-assisted instruction systems. The interactive nature of a stick figure that carries out foreign language commands is more important than detailed color pictures for many applications. The pictorial realism needed depends on the discriminations to be made and the state of the learner.

Where We Are

We are still in an early stage of interactive video development--a little like early moviemakers who simply pointed the camera at actors onstage, before non-sequential shooting with later edits, fades, and dissolves was developed. There was initially a tendency to simply transfer videotape or text to disc. Now, a new version and style is evolving. The BYU MONTEVIDISCO disc already cited is an example--the user encounters a series of situations in a Mexican town and must respond appropriately.

A major contributor to the popularity of interactive video is that it combines the power of computer-assisted instruction with the realism of face-to-face interactions in a package that can quickly be changed from a small town to a physician's office. The cost savings over actual experience can be prodigious.

Production Systems for Interactive Video

A production system is the set of procedures, people, and tools needed to transform ideas into finished interactive video products. Commercial groups with extensive videodisc contracts, like WICAT

Systems in Orem, Utah, have developed and used interactive video production systems. Al Bork at the Educational Technology Center at U.C. Irvine and Rod Daynes at the University of Nebraska are other leading developers of such production systems.

A production system includes far more than an authoring capability. For example, it may provide guidance for instructional and stylistic decisions, formats, role expectations, and tracking mechanisms. It includes, in two or more people, expertise in the subject matter, design and authoring, video and graphics production, and programming. This is a widely diverse set of skills and outlooks. Such diversity and the extent and complexity of the work often leads to misunderstandings. Subject matter experts, artists, TV directors, and programmers often do not understand each other's craft, yet interactive video programs require that the result smoothly integrate products from all of them.

The key player in this drama is the producer, whose vision must encompass not only the finished program as it will be, but also the manner by which each player will communicate with the others. The producer must be technically conversant with each craft and, in addition, be an excellent manager in order to orchestrate the outcome. It is a most trying and yet exciting position.

Interactive video producers must develop through experience since the field is so new. It is a little like the first pilots--you watch and observe, but the training is limited, so you eventually just climb in and take off.

A few guidelines have been produced. For example, WICAT has developed the *Interactive Videodisc: Design and Production Workshop Guide* (Campbell, Tuttle and Gibbons) for the Army Research Institute. The interactive video flowchart on which the production system is based has been published in *Videodisc News* (March 1982) and *Byte* (June 1982). The Videodisc Design Production Group at the University of Nebraska has developed *Producing Interactive Videodiscs*, with the Optical Recording Project at 3M. In addition, the Nebraska videodisc group regularly sponsors an excellent hands-on workshop for videodisc producers.

Authoring Languages for Interactive Video

Interactive video combines the capability of books, slide/tape, videotape, replica simulators, and computer-assisted instruction. It can also combine the production difficulties of each of these approaches. Even a simple linear simulation that moves from one picture to the next in an invariant sequence can require considerable programming in BASIC or PASCAL.

Design/authoring, video production, and programming are the primary components. Each can be surprisingly expensive. Total costs can range from about $50,000 to $200,000. The bulk of interactive video projects is toward the upper range.

The authors who never stop redesigning and rewriting; the video crew making decisions and getting set up in the studio while the clock ticks at several hundred dollars an hour; the programmer whose output can be predicted by taking the original time estimate, multiplying by two and going to the next higher unit of measure (one day becomes two weeks) are all classics in interactive video.

The most successful commercial strategy is to adopt a system that guides the authors to use diverse, but relatively consistent, formats and interactions. For example, the user may communicate via touch panel. The bottom line of the video screen is set aside for commands like NEXT, MENU, and HELP. A diversity of commands may be used, but within one section of the program only a certain set of commands is allowed. When they appear, the command labels are always in the same position on the screen.

This is a simple human factors design for the user, but also has major ramifications for video production and programming. If the command labels appear inconsistently at different locations, every interaction must be handcrafted by the video production crew and the programmer.

To the extent the interactions are consistent, an authoring language can be used. An authoring language is simply a tool that handles some of the details that frequently crop up. In CAI, multiple-choice questions with feedback and branching are easy to deal with. So CAI authoring languages often use a standard fill-in-the-blank template. On the other hand, modeling a complex system is peculiar to a particular application, so standard programming languages like PASCAL are usually used for these more complex or unusual situations.

For the interactive video revolution to have a major impact on training, the tools to create the programs need to be more easily accessible and less expensive. Video production, even of still frames, is a relatively mature technology, though it is still too expensive for many applications. On the other hand, programming interactive video simulations is very recent. Authoring languages are beginning to appear that facilitate preparation of interactive video programs. Examples include WISE from WICAT Systems (released for CAI authoring, with video authoring to be announced), Dick Brandt's system at the University of Utah, SUPER PILOT from Apple, PILOT PLUS from IIAT, and PASS from Bell and Howell. These languages range from a menu-driven system with graphics editor (WISE) to a simplified coding approach (PILOT).

Almost any programming language can run a videodisc player with the proper interface, but these do not qualify as authoring languages because they do not facilitate interactive video functions. There are many authoring languages designed for computer-assisted instruction that can be adapted to run videodisc delivery systems. Examples are TUTOR or PLANIT. The modification can be as simple as sending out a text string with certain control characters that are trapped by the videodisc interface and interpreted as commands to the player. This sort of conversation was done very successfully by WICAT several years ago under a contract from the Army Research Institute. Converting a CAI language is a partial solution to the problem, and it can greatly increase productivity. Nevertheless, adaptations of existing authoring languages for computer-assisted instruction are usually not tailored to video simulations.

Common functions used in interactive video language training include the following:

Present a still frame and receive user input (via touch panel, keypad, voice input system, or the like).

Present motion sequence.

Display computer-generated text and graphics either as an overlay on the video image or by themselves.

Other functions are used less frequently and may include modeling a system or handling a variety of simultaneous input and output devices (for example, simultaneous touch panel and keypad input with videodisc and tone generator output).

Some of these more common functions can be incorporated into an authoring language for interactive video by using a fill-in-the-blank template for each function. Other capabilities are peculiar to a specific program. Thus, designers of authoring languages have a choice of (a) providing a simplified but general-purpose programming language and requiring the author to learn the syntax and command structure, or (b) developing a menu-driven or template authoring language that requires no coding. In our experience the best approach is a hybrid, in which most presentations and response judging are menu-driven, but where a simple syntax can be used to create graphic displays and a window is left open to a standard programming language like PASCAL to handle special requirements. For graphics editing, the authoring language should be screen-oriented and immediately display results, so the author is, for example editing a graphic on the screen using a simple set of commands rather than editing the code that will generate the graphic. This visual immediacy is critical to increasing productivity of the authoring process.

Thus an interactive video authoring language should include the following:

Templates for common functions, such as playing motion sequences.

Menu-driven selections, such as choice of templates.

Screen oriented graphics using a simply syntax, such as used in WICAT's WISE.

A window through which the system can run modules that are coded in a standard programming language like PASCAL.

Programs differ dramatically in hardware components (e.g., touch panel, keyboard, or voice input), and in complexity (e.g., a linear simulation or a fully modeled simulation). Authoring approaches need to reflect this diversity. For most in-house production, an authoring language will suffice. However, as two screens, simultaneous input from two or more devices, and other complications arise, alternatives must be found. We have tried several approaches:

(1) Code in a programming language.

(2) Write a project-specific language that incorporates off-the-shelf standard templates, but adds new ones for the specific program.

(3) Create a new extensible language that allows the author to easily compose successively more complex procedures from a simple video-controlling primitive. Such a language resembles LOGO or FORTH and permits the author to write the program.

The first approach occurs when the situation is so constrained (the program must run on the videodisc player's computer and fit in the 1K memory space), or so unusual (a first time, experimental program) that an authoring language is not feasible.

The second approach is common where clients come to an interactive video producer like WICAT. They want to try out new configurations such as an interactive video system linked to a replica hardware simulator, or both a computer CRT terminal and a video screen active simultaneously, or a software model of a radar system. So long as the author uses a consistent format and approach, the programmer can design a template-based authoring system for the project. This approach is worthwhile for a large project.

The third approach is one with which we are now experimenting. It may allow authors to create their own special purpose templates without a programmer. This is done by starting with primitives that, for example, play a motion sequence, select a still, or place text on the screen. The author links these primitives into successively higher order statements as needed.

Conclusion

Interactive video opens the door to teaching procedural "how-to" foreign language interactions better than any medium available to date. Developing interactive video programs is surprisingly complex because subject matter expertise, authoring, video and graphic production, and computer software must all be combined. A team approach using a well-defined production system and a gifted producer is needed. Authoring systems facilitate the work by providing consistent structure as well as by simplifying coding. No single authoring language will handle the range of interactive video, although off-the-shelf authoring languges can handle the bulk of applications. Special purpose languages for single projects are worthwhile if the size of the project is large. The language may be designed by a programmer as a series of standard, plus project-specific templates. Alternatively an extensible language resembling LOGO or FORTH may allow the author to create higher order statements for common functions.

KEYNOTE SPEAKERS AND PRESENTERS

JAMES E. ALATIS
Dean, School of Languages
and Linguistics
303 Intercultural Center
Georgetown University
Washington, DC 20057
Phone: (202) 625-4301

THOMAS D. ARKWRIGHT
Lockheed Missiles and Space Co.
Box 60033
Sunnyvale, CA 94086
Phone: (408) 743-1230

JUNIUS L. BENNION
David O. McKay Institute
of Education
214 Knight Mangum Building
Brigham Young University 214 KMB
Provo, UT 84602
Phone: (801) 378-7685

CAPT MICHAEL BUSH
USAFA/DFF
USAF Academy, CO 80840
Phone: (303) 472-3820

FRANCIS A. CARTIER (Moderator)
Defense Language Institute
Foreign Language Center
(ATTN: ATFL-TD)
Presidio of Monterey, CA 93940
Phone: (408) 242-8495

MICHAEL DEBLOOIS
Department of Instructional
Technology
Utah State University
Logan, UT 84321
Phone: (801) 750-2698

MARC RICHARD-FOGG
Marc Fogg Software
2550 Webster Street
San Francisco, CA 94115
Phone: (415) 931-6019

LARRIE E. GALE
David O. McKay Institute of
Education
121 KMB Brigham Young University
Provo, UT 84602
Phone: (801) 378-7082

KARL-PETER GRUNE
Deputy Director
Goethe Institute
530 Bush Street
San Francisco, CA 94108
Phone: (415) 391-0370

GLYN HOLMES
Language Laboratories
University of Western Ontario
London, Ontario N6A 3K7 Canada
Phone: (519) 679-2555

STAN JARVIS
Electronic Information Services
P. O. Box 151044
Salt Lake City, UT 84115
Phone: (801) 254-2887/2014

RANDALL JONES
Department of German
285 Maeser Building
Brigham Young University
Provo, UT 84602
Phone: (801) 378-3513

DALE V. LALLY, JR.
University of Louisville
Arts and Sciences Learning Lab
Bingham Humanities 16
Louisville, KY 40292
Phone: (502) 588-5924

CARL R. LEHFELDT
Acurex
555 Clyde
Mountain View, CA 94942
Phone: (415) 964-3200

PAUL LUCKAU
Brigham Young University
Department of German
255 MSRB
Provo, UT 84602
Phone: (801) 378-2169

PAUL MADARASZ
Defense Language Institute
Foreign Language Center
(ATTN: ATFL-TD-AD)
Presidio of Monterey, CA 93940
Phone: (408) 242-8638

LAWRENCE MARKOSIAN
(Representing Stanford U.)
Senior Computer Scientist
Systems Control Technology, Inc.
1801 Page Mill Road
Palo Alto, CA 94303
Phone:

HANNO MARTIN
Director
Goethe Institute, York
86 Miklegate
York, YO1 1JZ, Great Britain
Phone: (0904) 55222

COL DAVID A. McNERNEY
Commandant
Defense Language Institute
Foreign Language Center
(ATTN: ATFL-CMT)
Presidio of Monterey, CA 93940
Phone: (408) 242-8312

FRANK OTTO
Linguistics Department
Brigham Young University
158 Fletcher Building
Provo, UT 84602
Phone: (801) 378-2349

SUE OTTO
University of Iowa
125 Schaeffer Hall
Iowa City, IA 52242
Phone: (319) 353-3190

JIM PUSACK
University of Iowa
103 Schaeffer Hall
Iowa City, IA 52242
Phone: (319) 353-5098

JOAN RUBIN
Specialist in Language and Cross-Cultural Skills
P. O. Box 143
Pinole, CA 94564
Phone: (415) 724-0767

JOHN R. RUSSELL
State University of New York at Stony Brook
Germanic and Slavic Languages
Stony Brook, NY 11794
Phone: (516) 246-6830

RUTH H. SANDERS
Miami University
Department of German, Russian, and East Asian Languages
Oxford, OH 45056
Phone: (513) 529-2231

EDWARD W. SCHNEIDER
Syracuse University School of Education
105 Huntington Hall
Syracuse, NY 13210
Phone: (315) 423-3703

BRIAN SCOTT
Scott Instruments
1111 Willow Springs
Denton, TX 76201
Phone: (817) 387-9514

DAVID M. WEIBLE
University of Illinois at Chicago
Audio Information Service
Room 203, Grant Hall
Box 4348
Chicago, IL 60680
Phone: (312) 996-8836

DAVID H. WYATT
Consultant (Formerly with
American Language Academy,
Catholic University)
4614 Chase Avenue
Bethesda, MD 20814
Phone: (301) 652-8468

TEXT SUBMITTED
Dr. J. Olin Campbell
474 West 610 South
Orem, UT 84057
Phone:

FLINT CONFERENCE ATTENDEES

ANTOINE AL-HAIK
Directorate of Evaluation and
Standardization
Measurement Standards Division
Defense Language Institute
Foreign Language Center
(ATTN: ATFL-ES-M)
Presidio of Monterey, CA 93940
Phone: (408) 242-8517

JULIE ANN ARCHER-KATH
(Columbia Heights Schools
FL Coordinator)
German Teacher, Central
Middle School
900 49th Avenue NE
Columbia Heights, MN 55421
Phone: (612) 574-6505

DONALD R. BAKER
Cryptologic Linguist
Training Manager
3480 Technical Training Group/TTK
Goodfellow AFB, TX 76908
Phone: (915) 653-3231, Ext 2327

ROBERT L. BAKER
Associate Director
The Middlebury College
Language Schools
Middlebury, VT 05753
Phone: (802) 388-3711, Ext 2535

HENRY F. (HANK) BANNISTER
Director
Micro Consulting Northwest
911 SE 21st Avenue, Suite #209
Portland, OR 97205
Phone: (503) 227-5150

CECILIA C. BAUMANN
Director, Oldenborg Center for
Modern Languages and
International Relations
Pomona College
Claremont, CA 91711
Phone: (714) 621-8018

RUDOLF BERGER
Goethe Institute
Referat 41
Postfach 201009
8000 Munchen 2
West Germany
Phone: 89-5999-481

RAY T. CLIFFORD
Academic Dean
Defense Language Institute
Foreign Language Center
(ATTN: ATFL-AD)
Presidio of Monterey, CA 93940
Phone: (408) 242-8291

LORE COLBY
Saddleback College
Department of Humanities and
Languages
28000 Marguerite Parkway
Mission Viejo, CA 92675
Phone: (714) 831-4788

CATHARINE M. COLECCHI
Technical Staff
Mitre Corporation
Box 208
Bedford, MA 01730
Phone: (617) 271-7572

ASTRID CONBOY
Humboldt State
Foreign Language Department
Arcata, CA 95521
Phone: (707) 826-3226

BETH CONCANNON
Harvard University
Cronkhite Graduation Center #328
Cambridge, MA 02138
Phone:

REX C. DAHL
Department of Modern Languages
Montana State University
Bozeman, MT 59717
Phone: (406) 994-4448

AUGUST JOS DE BERDT
Associate Prof/Head
FL Department
Berry College
P. O. Box 5021
Mount Berry, GA 30149
Phone: (404) 232-5374, Ext 2414

HENRY W. DECKER
Associate Professor of French
University of California, Riverside
Department of Literatures and Languages
Riverside, CA 92521
Phone: (714) 787-3571

PIERRE DE LESPINOIS
Director of Training
Defense Language Institute
Foreign Language Center
(ATTN: ATFL-DT)
Presidio of Monterey, CA 93940
Phone: (408) 242-8463

JAMES W. DODGE
Technical Advisor
Middlebury College
Sunderland Language Center
Middlebury, VT 05753
Phone: (803) 388-3711, Ext 2513

PETER A. EDDY
Chief, S&G
CIA Language School
Washington, DC 20505
Phone: (703) 351-3271

ALISON FIELDS
Senior Project Officer
CIA/ORD
Washington, DC 20505
Phone: (703) 351-2701

PAUL A. GARCIA
Chairman, Foreign Languages
Southwest High School
6512 Wornall Road
Kansas City, MO 64113
Phone: (816) 523-2622, Ext 0

JANET GLESS
German Teacher
Hayward High School
1633 East Avenue
Hayward, CA 94541
Phone: (415) 784-2667

JOE HAMBROOK
British Broadcasting Corporation
P. O. Box 76
Bush House Strand
London WC2B 4PH
Great Britain
Phone:

LT COL DANIEL G. M. HANNAWAY
Professor and Head
Department of FL
USAF Academy
Colorado Springs, CO 80840
Phone: (303) 472-3820

HOWARD H. HATHAWAY
Supervisor, World Language and Cultures
St. Paul Public Schools
360 Colborne Street
St. Paul, MN 55102
Phone: (612) 293-7807

ILSE JOANA HEINLE
Director, Language Department
Goethe Institute
Place Bonaventure, B.P. 428
Montreal, P.Q. Canada
Phone: (514) 866-1081

HEINZ HEINRICHS
Head of the Language Department
Goethe Institute
1067 Yonge Street
Toronto, Canada M4W 2L2

KATHE J. HINES
Teacher
Hayward Unified School District
414 41st
Oakland, CA 94609
Phone:

BOB HUMPHREYS
VBLS, National Fieldman
Scott Instruments
1111 Willow Springs
Denton, TX 76201
Phone: (817) 387-9515

JOHN IRVING
Professor of German, CSUN
California State University,
Northridge
18111 Nordhoff Street
Northridge, CA 91330
Phone: (213) 885-3467

BARBARA A. JOHNSON
Language Lab Director
Department of Foreign
Languages and Literatures
Washington State University
Pullman, WA 99164
Phone: (509) 335-8715

ROBERT A. JONES
Acting Coordinator, Language
Laboratories
University of Wisconsin-Milwaukee
P. O. Box 413
Milwaukee, WI 53201
Phone: (414) 963-4313

KAREN J. KELLEY
Education Specialist/FLINT
Coordinator
Defense Language Institute
Foreign Language Center
(ATTN: ATFL-TD-ET)
Presidio of Monterey, CA 93940
Phone: (408) 242-8475

MINNIE M. KENNY
Deputy Assistant Director
of Training
National Security Agency
9800 Savage Road
Fort George G. Meade, MD 20755
Phone: (301) 859-6335

CHRISTA KIRBY
Coordinator, FL Department
School Board of Pinellas County
205 4th Street SW
Largo, FL 33540
Phone: (813) 585-9951

CARL LOVITT
Assistant Director FL Program
Modern Language Association
62 5th Avenue
New York, NY 10011
Phone: (212) 741-5592

GUNTHER A. MUELLER
Deputy For Instruction
Chairman of German
USAF Academy
Department of Foreign Languages
Colorado Springs, CO 80840
Phone: (303) 472-3820

JEAN NICHOLS
Research Scientist/Project
Manager
CIA/Office of Research and
Development
Washington, DC 20505
Phone: (703) 351-2701

CASIMIR NORKELIUNAS
Head, Department of Modern
Languages
Marist College
Poughkeepsie, NY 12601
Phone: (914) 471-3240

DONALD PERRIN
Director, Instructional
Media Center
California State University,
Northridge
18111 Nordhoff Street
Northridge, CA 91330
Phone: (213) 885-2205

NANCY E. POST
Course Development Specialist
American Language Academy
Catholic University
11426 Rockville Pike
Rockville, MD 20852
Phone: (301) 984-3400

CONSTANCE E. PUTNAM
Executive Editor, School Div
FL Department
Houghton Mifflin Company
One Beacon Street
Boston, MA 02108
Phone: (617) 725-5278

MICHAEL ROEDER
Goethe Institute, Atlanta
400 Colony Square
Atlanta, GA 30361
Phone: (404) 892-2388

MAJOR A. ALLEN ROWE
Chief, Educational
Technology Division
Defense Language Institute
Foreign Language Center
(ATTN: ATFL-TD-ET)
Presidio of Monterey, CA 93940
Phone: (408) 242-8475

CHRISTA RUTSCHE
Instructor, German Gateway
Defense Language Institute
Foreign Language Center
(ATTN: ATFL-DT-G)
Presidio of Monterey, CA 93940
Phone: (408) 242-8201

FRANK L. RYAN
Director of Language Lab
Brown University
Marston Hall
20 Manning Street, Box E
Providence, RI 02912
Phone: (401) 863-2754

RICHARD SCHNEIDER
Goethe Institute, Atlanta
400 Colony Square
Atlanta, GA 30361-2401
Phone: (404) 892-2388

CHRIS SETTEMBER
Admininstrative Assistant
FLINT Coordinator
Goethe Institute
530 Bush Street
San Francisco, CA 94108
Phone: (415) 391-0370

KAZ SHITAMA
Dean of National Cryptologic School
National Security Agency
Fort George G. Meade, MD 20755
Phone:

DON SMITH
DLI Russian Branch
Defense Language Institute
Foreign Language Center
(ATTN: DLIELC/FLC)
Lackland AFB, TX 78236
Phone: (512) 671-3552

JAMES SOPER
Instructor
Monterey Institute of
International Studies
425 Van Buren
Monterey, CA 93940
Phone: (408) 649-3113

HARRY E. STEWART
Head, Department of Languages
Clemson University
201 Strode Tower
Clemson, SC 29631
Phone: (803) 656-3393

RICHARD THOMA
Director
Goethe Institute
3400 Montrose Boulevard
Suite 808
Houston, TX 77006
Phone: (713) 523-0966

RICHARD THOMPSON
Director, Division of Advanced
Training and Research
Department of Education
400 Maryland Avenue SW
ROB-3, Room 3923
Washington, DC 20202
Phone:

LT COL ROLF A. TRAUTSCH
Deputy Director
Training Development
Defense Language Institute
Foreign Language Center
(ATTN: ATFL-TD)
Presidio of Monterey, CA 93940
Phone: (408) 242-8679

ALLEN I. WEINSTEIN
Chairman, Department of
Resources and Support
Foreign Service Institute
(U.S. Department of State)
School of Language Studies
1400 Key Boulevard, Room 901
Arlington, VA 22209
Phone: (703) 235-8816

FRITZ WIDMAIER
Associate Professor
Department of German
McMaster University
Hamilton, Ontario,
Canada L8S4M2
Phone: (416) 525-9140, Ext 4201

JOHN WOLLSTEIN
Program Specialist for Asian,
European, and Pacific Languages
Hawaii State Department of
Education
189 Lunalilo Home Road, 2d Floor
Honolulu, HI 96825
Phone: (808) 395-8252

FLINT CONFERENCE EXHIBITORS

ASHBY ASSOCIATES OF
NORTHERN CALIFORNIA
1999 Heatherdale Avenue
San Jose, CA 95126
Phone: (408) 984-2221

COMPUTER CURRICULUM CORP.
1070 Arastradero Road
P. O. Box 10080
Palo Alto, CA 94304
Phone: (415) 494-8450

CONTROL DATA CORP.
Education and Training Systems
1330 Orleans Drive
Sunnyvale, CA 94086
Phone: (408) 744-5045

MULTI MEDIA VIDEO, INC.
Educational Department
3350 Scott Boulevard, Bldg 21
Santa Clara, CA 95051
Phone: (408) 727-1733

RADIO SHACK
484 Washington Street
Monterey, CA 93940
Phone: (408) 375-8430

SCOTT INSTRUMENTS
1111 Willow Springs Drive
Denton, TX 76201
Phone: (817) 387-9514

SONY VIDEO PRODUCTS CO.
1005 Elwell Court
Palo Alto, CA 94303
Phone: (415) 961-9060

WEIDNER COMMUNICATIONS
2105 1/4 North Highland Avenue
Los Angeles, CA 90068
Phone: (213) 851-1566

WHITNEY EDUCATIONAL SERVICES
1777 Borel Pl, #402
San Mateo, CA 94402
Phone: (415) 570-7917

WICAT SYSTEMS
180 Grand Avenue, Suite 1055
Oakland, CA 94612
Phone: (415) 834-6723

GPO 687-001/7330